Wastewater System Improvements Project
Environmental Assessment

City of Bisbee, Cochise County, Arizona

Prepared pursuant to the National Environmental Policy Act (NEPA)
42 U.S.C. 4332 (2) (C), 16 U.S.C. 470, 49 U.S.C. 303 and 23 U.S.C. 138
for the

U.S. Environmental Protection Agency

April 2003

The following person may be contacted for information concerning this document:

Doug Liden
U.S. Environmental Protection Agency
75 Hawthorne Street, WTR-4
San Francisco, CA 94105
Phone (415) 972-3406
Fax (415) 947-3537
Email: liden.douglas@epa.gov

Table of Contents

Table of Contents

Tables

Figures

Appendix

Section 1 – Introduction

1.1 Legal Framework

In November 1993, the United States and Mexico signed the *Border Environmental Cooperative Commission-North American Development Bank* agreement, creating an international environmental infrastructure program to address water, wastewater, solid waste, and other issues which threaten the quality of water and soil in the border region. *(EPA 2000).*

The Border Environment Cooperative Commission (BECC) is an international organization that aids in the financing and development of environmental infrastructure projects proposed by border states, localities and the private sector along the US/Mexico border. The main role of the BECC is to assist states and local communities in developing projects, analysing the environmental and financial aspects of projects, evaluating the social and economic benefits of projects, and provide certification for funding opportunities through the North American Development Bank (NADBank). The NADBank is an international financial institution that can provide loans, loan guarantees and other assistance to projects certified by the BECC *(EPA 2000).*

The U.S. Environmental Protection Agency (EPA) is charged with ensuring environmental quality and therefore plays a key role in the development of environmental infrastructure within the United States. The EPA also administers construction grants for border projects, and works as a partner with the BECC and NADBank to ensure that EPA infrastructure funds are used for high-quality projects.

The BECC certification process requires that a certified project comply with applicable state and federal environmental assessment requirements. After a project is certified by the BECC, it becomes eligible for Border Environmental Infrastructure Funds (BEIF) from the NADBank.

To meet the environmental assessment requirements for BECC compliance, EPA must follow their regulatory provisions for compliance with the National Environmental Policy Act (NEPA) *[40 CFR Part 6]* when making decisions regarding the use of border funds. This environmental assessment (EA) has been prepared in accordance with those provisions and satisfies the required environmental analyses for BECC certification. This EA is also being prepared to meet the environmental review requirements of the USDA Rural Development Rural Utilities Service *[7 CFR Part 1780 and 1794]* and the Water Infrastructure Finance Authority of Arizona - Clean Water Revolving Fund program *[Arizona Admin. Code Title 18, Chapter 15, Article 1, Section R]8-15-107]*.

1.2 Purpose of the Environmental Assessment

The City of Bisbee, Arizona (City) is developing an infrastructure project to address wastewater system deficiencies and to comply with state and federal regulatory requirements. The project is being developed and funded in coordination with the BECC, the USDA Rural Development - Rural Utilities Service and the Water Infrastructure Finance Authority of Arizona. The purpose of this EA is to determine and document the potential beneficial and adverse impacts to the environment within the study area generated by implementation of the proposed action.

Presently the City is operating under a Consent Order issued by the Arizona Department of Environmental Quality (ADEQ) to address substantial inflow/infiltration (I/I) and effluent quality issues with the existing wastewater collection and treatment system. Additionally, EPA has issued a Finding of Violation and Notice for Compliance to the City to address discharge permit violations.

For the project to be certified by BECC and be eligible for funding, an EA in accordance with requirements of NEPA must be performed. This EA is being prepared to determine if a Finding of No Significant Impact (FONSI) can be prepared for the proposed action. A FONSI precludes the need to perform an Environmental Impact

Statement (EIS), while a finding of potentially significant impact during development of an EA dictates that an EIS is required. The EA was prepared in accordance with:

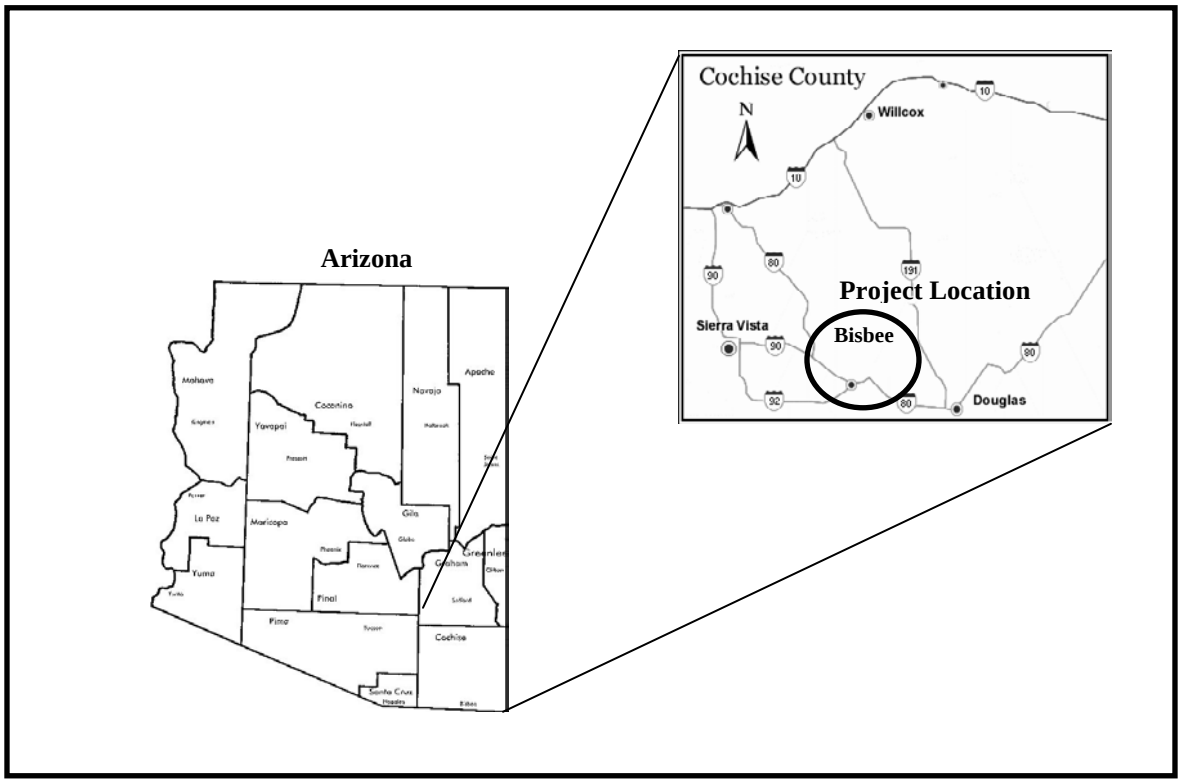
- Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act *[40 CFR Parts 1500~1508];*
- EPA Procedures for Implementing the Requirements of the Council on Environmental Quality on the National Environmental Policy Act *[40 CFR Part 6];*
- Guide for Preparing the Environmental Report for Water and Wastewater Projects - USDA Rural Utilities Service Bulletin 1794A-602, Version 1.0
- Water Infrastructure Finance Authority of Arizona - Arizona Admin. Code Title 18, Chapter 15, Article 1, Section R18-15-107.

1.3 Project Location

The proposed action is located within the City of Bisbee, Cochise County, Arizona (Figure 1). Bisbee is located in southern Cochise County, approximately 4.0 mi (6.4 km,) north of the U.S./Mexico border, and serves as the county seat of Cochise County. The City is comprised of three distinct population centers: Old Bisbee, Warren, and San Jose.

The study area for this EA includes the incorporated City limits (including the Old Bisbee, Warren, and San Jose communities), a 0.25 mi (0.4 km) diameter area centered on each wastewater treatment plant site, and an area extending downstream at least 1.0 mi (1.6 km) from the discharge point of each existing and proposed wastewater treatment plant (WWTP) and discharge location (Figure 2, Appendix A).

Figure 1. Project Location Map



1.4 Project Purpose and Need

The purpose of the proposed project is to rehabilitate the wastewater collection and treatment system in the City of Bisbee, Cochise County, Arizona to address existing system deficiencies and achieve compliance with state and federal regulatory requirements. To rectify the current deficient situation and prevent fines under Section 309 of the Clean Water Act *[3 U.S.C. Section 1319 (b)]*, the City must take action to prevent the further decline of effluent quality.

The City is served by a collection system that varies widely in age and condition, and the majority of the system in the Old Bisbee and Warren areas of the City experiences excessive inflow/Infiltration (I/I). The I/I condition results in sanitary sewer overflows and exceedance of treatment plant quantity and quality capacities, culminating in releases of raw or partially treated sewage to the environment.

Wastewater treatment is conducted at three separate facilities, one for each of the three population centers. The treatment facilities vary in age and condition, and the City has difficulty maintaining compliance with permits and current regulatory standards. For example, the Mule Gulch WWTF is not designed to remove metals from the influent, and in the past the facility has been in violation of the allowable metals effluent mass loading or effluent concentrations for a variety of metals under its National Pollutant Discharge Elimination System (NPDES) permit. The City received a Finding of Violation and Order for Compliance from EPA on June 8, 2000. The letter noted that violations consist of three unreported monitoring results for lead and copper and exceedance of the allowable discharge limits for selenium, chromium, lead, copper, mercury and cyanide. A new NPDES permit for the Mule Gulch WWTP was issued to the City effective June 24, 2002. In this permit, effluent standards for metals were adjusted to reflect the actual hardness of the wastewater stream. The facility is now generally in compliance with current NPDES permit requirements, however issues with concentration and mass loading for some metals remain, especially during periods of high I&I.

Presently, the City is operating under a consent order issued by ADEQ to address the I/I problems. On September 9, 1996, the City entered into Consent Order P-96-96 with ADEQ to obtain approved Aquifer Protection Permits for the Warren WWTP and the San Jose WWTP as well as complete repairs on the collection and conveyance system to eliminate untreated or partially treated sewage discharges caused by excessive system I/I during periods of heavy precipitation. The order also placed a moratorium on connections of any type to the Mule Gulch and Warren Sewer Systems until corrective action on the I/I issues was taken. The Consent Order required completion of these tasks by September 9, 2001, and many tasks were completed however the City and ADEQ concluded in 1999 that the City did not have sufficient resources to fully meet the 2001 compliance deadline imposed by the order.

On April 14, 2001, the City entered into a new Consent Order (P-54-01) with ADEQ. This action replaced the 1996 order and requires completion of collection system improvements identified in Alternative 4 of the City 2001 Wastewater Master Plan (*City of Bisbee 2001*); construction of a new San Jose WWTP with secondary treatment, denitrification and permittable disposal capabilities (also identified in Alternative 4 of the 2001 Wastewater Master Plan); and submittal of an APP application for an expanded and improved San Jose WWTP. Consent Order P-54-01 also continues the moratorium on new connections to sewage collection systems in Old Bisbee and Warren areas enacted with the 1996 order.

Even with the improvements to the system made by the City since 1996, the existing wastewater system experiences ongoing issues and deficiencies. Figure 3 is a representative list of events that occurred over the three-year period from 1999 to 2001.

Figure 3. Bisbee Wastewater System Deficiencies 1998 - 2000

1998

January	February	April	May	October
Mule Gulch WWTP design capacity exceeded	Mule Gulch WWTP design capacity exceeded Untreated wastewater discharged To Mule Gulch	Untreated Wastewater Discharged To Mule Gulch	Operating Deficiencies Noted At Warren WWTP	City Submits Consent Order Compliance Schedule to Correct I/I Problems City Resubmits APP Application for Mule Gulch WWTP

1999

April	May	July	July - August	August
ADEQ agrees with City that sufficient funding and resources are not currently available nor in place to meet the 2001 compliance deadline for Consent Order P-96-96	Operating deficiencies noted At Warren & San Jose WWTPs	Partially treated effluent from the Warren WWTP combined with storm water and indirectly discharged into Greenbush Draw	Design operating capacity at Mule Gulch WWTP exceeded	Partially treated effluent from the Warren WWTP combined with storm water and indirectly discharged into Greenbush Draw

2000

May	August	October	November	December
Operating deficiencies noted At Warren & San Jose WWTPs	Design operating capacity at Mule Gulch WWTP exceeded	Partially treated effluent from the Warren WWTP combined with storm water and indirectly discharged into Greenbush Draw Design operating capacity at Mule Gulch WWTP exceeded	City Mayor and Council decide to adopt and implement Alternative 4 of the City 2001 Wastewater Master Plan	ADEQ notifies City that APP permit applications for the existing WWTPs will be denied in response to City's intent to construct new WWTP at San Jose

In general, the poor condition of the sanitary sewer transmission lines requires replacement to adequately meet the conditions of the consent order. The City has obtained a Community Development Block Grant (CDBG) grant and funding from the USDA Rural Utilities Service to rehabilitate small sections of the collection system in Old Bisbee and Warren. The majority of the collection system in these areas, however, is still in need of rehabilitation. Improvements to the wastewater treatment process are also necessary to address discharge permit violations and adequately protect groundwater resources and public health.

1.5 Project Description

Currently, wastewater from the three sections of the City is collected and transmitted to three separate treatment systems (Figure 4, Appendix A).

1.5.1 Old Bisbee Area

The Mule Gulch Wastewater Treatment Plant treats all wastewater collected from the Old Bisbee, Lowell and Saginaw sections of the City, serving approximately 1,800 residents. Additionally, the facility collects and treats wastewater generated from the Cochise County Jail complex located on Highway 80 east of Saginaw. The collection system in the Old Bisbee portion of the city consists of a separate system of vitrified clay, transite, and cast iron pipes. The approximate 15 miles of pipes in Old Bisbee range in size from 4-inch to 12-inch in diameter and flow to a 12-inch trunk line leading to the Mule Gulch WWTP. These pipes were originally installed in the early-1900s and much of the system is heavily deteriorated and undersized to meet existing requirements. Approximately 61% of the existing collection system in the Old Bisbee area is comprised of 4-inch or 6-inch pipe. Additionally, much of the sewer line in the Old Bisbee section is laid on excessive grades, many more than 30%. The depth of the majority of sewer lines is less than 3.0 feet.

The Mule Gulch WWTP was originally constructed in 1941. Overall condition of the plant is fair to poor. The plant uses a trickling filter process to treat wastewater influent with anaerobic digestion and drying beds to treat wasted biological solids. The WWTP discharges treated, disinfected effluent to the Mule Gulch arroyo under a NPDES permit. The plant generally meets the effluent standards of the current NPDES permit, however issues with concentration and mass loading remain for some metals during periods of high I/I.

The plant has a design treatment capacity of 230,000 gpd. However, due to significant I/I problems associated with the collection system leading to the Mule Gulch WWTP, peak flows of 1,200,000 gpd have been experienced over short durations during storm events. These flows overwhelm the capacity of the plant and result in the discharge of effluent that has not been fully treated.

1.5.2 Warren Area

This system serves approximately 2,100 residents of the Warren area. The wastewater collection system in the Warren area of the City consists of approximately 18 miles of pipe ranging in size from 4-inches to 12-inches in diameter. Grades in Warren are in the 5% range, although some pipes are laid on flat grades, resulting in cleaning problems.

Most of the pipes in this area are constructed of vitrified clay, although some of the smaller sections of pipe are cast iron. As in Old Bisbee, most of the system is too small to meet existing requirements. Approximately 68% of the existing collection system in the Warren area is comprised of 4-inch or 6-inch diameter pipe. Additionally, in the Warren area, approximately 25% of the system has domestic water mains placed over sanitary sewer lines in the same trench, posing, a potential health hazard, difficult maintenance, and an additional source of 1/1. The sanitary sewer pipes lead to a 12-inch trunk line that conveys the sewage to the Warren lagoon system, approximately 1.5 miles south of Warren.

The Warren WWTP is located on approximately 56 acres owned by the City. The site is bordered by land owned by Phelps Dodge on all sides. The Warren WWTP was constructed in the 1970s. The WWTP uses a lagoon system treatment process comprised of four stabilization ponds, each having a surface area of approximately 3.75 acres, and a one-acre holding pond. The fourth stabilization pond was constructed in 2002 as required by Consent Order P-54-01. Effluent from the WWTP is disposed via land application at the 40-acre site effluent disposal area immediately south of the lagoons. The maximum design treatment capacity of the 4 lagoons at the Warren WWTP is approximately 390,000 gpd, however, significant I/I issues also exist in Warren and peak daily flows of 1,200,000 gpd have been experienced. Currently, the first lagoon is filled with solids, reducing the treatment capacity of the system by approximately one-quarter.

1.5.3 San Jose Area

This system serves approximately 1,000 residents of the San Jose area. Sanitary sewer transmission pipes in this area range in size from 4-inches to 6-inches in diameter and connect to a 10-inch or a 15-inch trunk sewer that leads to the San Jose WWTP. Pipes are constructed of asbestos cement and are laid on fairly gentle grades.

The San Jose WWTP is located on a 59-acre property owned by the City. The site is bordered by land owned by Phelps Dodge Mining Co. and other private owners on all sides. Construction of the San Jose WWTP was completed in 1985. The WWTP uses a lagoon treatment process system that includes two 2.69-acre facultative lagoons and a holding pond discharging to an 11-acre land application effluent disposal site southwest of the lagoons. This system has a design treatment capacity of approximately 137,000 gpd; peak daily flows of 240,000 gpd are experienced during periods of precipitation. The first lagoon at the San Jose WWTP is filled with solids, reducing treatment capacity by one-half.

A sulfate plume, created by mine dewatering activities that occurred between 1904 and 1985, exists in the water table beneath the San Jose WWTP. Reclaimed water discharged through the San Jose land application site reenters the aquifer inside the plume boundary.

1.5.4 Future Wastewater Treatment Needs

The required system capacity is based on the system population anticipated for the future and the average daily wastewater flow that each member of the population will contribute.

The system population was developed using 20-year population projections obtained from the Arizona Department of Economic Security plus known or anticipated additions that will occur during the same period. Table 1 shows the development of the future system population.

Brown and Caldwell, Inc. conducted a wastewater flow study for the City between July 12 and August 8, 2002. In this study, flow meters were placed in five manholes that represent total system flow when combined. The study spanned dry-weather and monsoon-influenced wet-weather conditions. The average daily flow measured during the dry-weather portion of the study was 0.58 million gallons per day, which equates to an average of 112 gallons per day per member of the current sewer system population. This rate combines all residential, commercial and industrial contributions and it is assumed it will stay constant in the future. Application of this rate to the future sewer population shows that a total system capacity of 820,000 gallons per day is needed to accommodate the future wastewater treatment needs of the City.

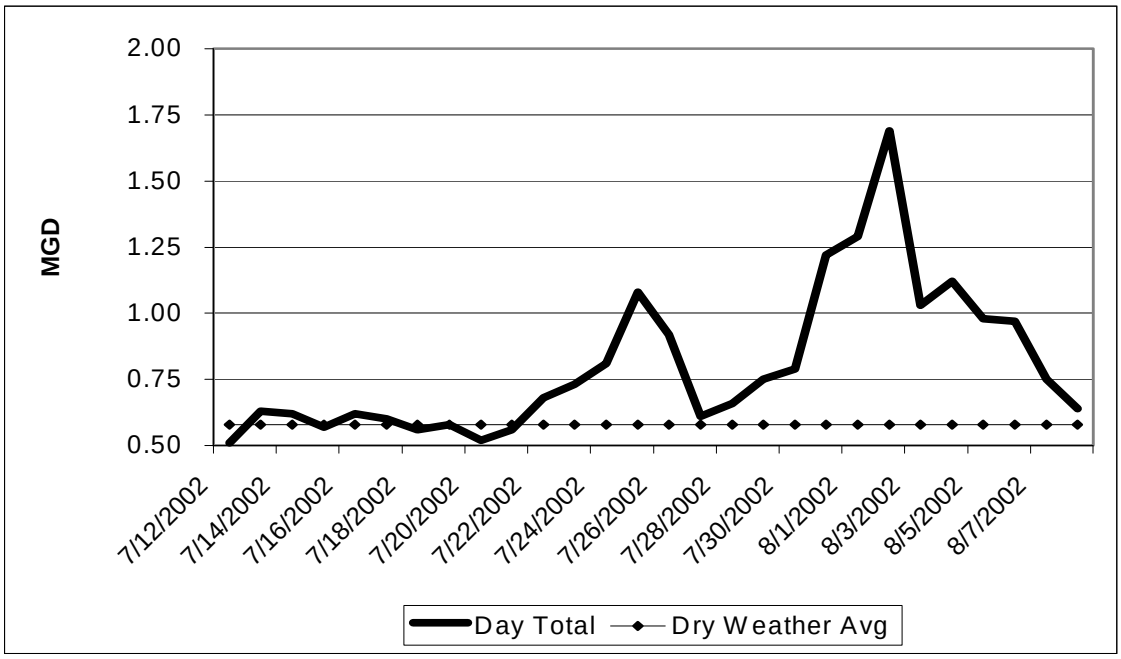
Table 1. Sewer System Population

Resident Population (2000 Census)	6,090
County Jail Population	240
Population on Private Septic Systems	(1,190)
Current Sewer System Population	5,140
Resident Population Growth	600
Private Septic Systems Eliminated	950
Daily Tourist/Seasonal Visitor Growth	500
Office/Commercial Growth	50
Future Sewer System Population	7,240

Full-Time Resident Population Equivalents. Non-resident figures derived from standard industry factors. 1 inmate = 1.2 full-time resident; 1 tourist/seasonal visitor = 0.5 full-time resident; 1 office/commercial = 0.2 full-time resident

The chart below shows total daily flows measured during the 2002 Wastewater Flow Study and highlights the impact of wet weather on the current system.

Bisbee 2002 Wastewater Flow Study



Section 2 - Alternatives Considered

The City has recently completed a Wastewater Master Plan (*City of Bisbee 2001*) to address the noted deficiencies throughout the collection and treatment systems currently in place. The Master Plan evaluated the proposed costs and infrastructure requirements of the collection system improvements and four treatment system improvement alternatives.

2.1 Collection System Improvements

The Wastewater Master Plan for the City identified the need to repair approximately 112,000 linear feet of collection system, predominantly in the Old Bisbee and Warren areas of the City. Collection system repairs are proposed to be completed in phases over a 7-10 year period. Collection system improvements would involve either excavation replacement or internal rehabilitation (trenchless methods).

Where practical, internal rehabilitation methods are recommended for the repair of deteriorated sewers in the Old Bisbee portion of the City to minimize excavation and resultant impacts on historic features and commercial and tourism interests. Internal rehabilitation methods to be evaluated for rehabilitation of the Old Bisbee area are:

- Chemical grouting: A liquid chemical grout that solidifies after curing is remotely applied under pressure to leaking joints and small cracks in the sewer.

- Cured-in-place lining: An internal liner is formed by inserting a resin-impregnated felt tube through the manhole into the sewer. The liner is then expanded against the inner wall of the existing pipe and allowed to cure.

- Fold and form liner: A folded thermoplastic pipe is pulled into place through a manhole and then rounded, using heat or steam and pressure to conform to the internal diameter of the existing pipe.

- Sliplining: An access pit is excavated adjacent to an existing sewer and a flexible liner pipe of slightly smaller diameter is slid into the existing pipe to create a continuous, watertight liner between the two manholes.

- Pipe Bursting: An access pit is excavated adjacent to an existing sewer and the pipe is broken outward by means of an expansion tool. A flexible liner pipe of equal or larger diameter is pulled behind the bursting device as a replacement sewer.

In other areas of the City, the decision on excavation versus internal methods will be based upon the structural condition of existing piping, underground obstructions and utilities, groundwater and soil characteristics, hydraulic and system issues, and environmental and socio-economic concerns.

The collection system improvements would utilize the same methods regardless of the wastewater system alternative implemented. For this EA, the collection system improvements are considered as part of each proposed treatment system alternative, except for the No Action alternative.

2.2 Treatment System Alternatives

The following wastewater treatment improvement alternatives were developed through the City Wastewater Master Plan. Each of the alternatives considered, with the exception of the No Action alternative, includes the proposed collection system improvements. Each alternative provides a wastewater treatment system with a design flow of 820,000 gpd to meet the need outlined in Section 1.5.4 of this assessment.

2.2.1 No Action Alternative

The No Action alternative is evaluated to provide a reference for comparison of the potential environmental consequences associated with the action alternatives under consideration for rehabilitation of the City wastewater system. Implementation of this alternative would result in no improvements to the identified deficiencies of the wastewater collection and treatment system in the City of Bisbee. The City would continue to have a wastewater collection system with numerous structural deficiencies and continue to experience substantial I/I problems.

Wastewater would continue to be treated at the three existing WWTPs operated by the City. Flows from the Old Bisbee area would continue to be treated at the Mule Gulch WWTP. Peak period flows would continue to exceed the capacity of this WWTP, resulting in discharges of untreated or partially treated sewage into Mule Gulch. The Mule Gulch WWTP would continue to have the potential to be in non-compliance with the conditions of their NDPES permit, especially related to effluent metal concentrations. Wastewater treatment facilities at Warren and San Jose would also continue to operate under their current condition. Age and poor operating conditions would continue to hamper the ability of these WWTPs to adequately function and discharges of untreated wastewater into Greenbush Draw from the Warren WWTP would continue to occur during peak influent periods. Water reclaimed at the San Jose WWTP would continue to be returned to the aquifer within the boundary of the sulfate plume.

Under the no action alternative, the City would continue to operate under a Consent Order/Notice for Compliance and the current growth moratorium would continue indefinitely. Sewer overflows and effluent violations would continue to threaten the quality of area surface and ground water resources. Fines accumulated from continued consent order impositions and those from effluent quality violations would continue to severely strain the financial status of the City. Community and economic development efforts would be severely hampered by the lack of adequate wastewater infrastructure.

Finally, the no action alternative would violate the terms of the Consent Order that requires the City to take action and address the existing situation.

2.2.2 Alternative 1

Alternative 1 proposes improvements necessary to maintain operational service of the three existing wastewater treatment facilities (Figure 5, Appendix A). This alternative was evaluated to consider the cost of keeping all three treatment facilities open while minimizing the need to expand the treatment facilities and disposal areas and the transfer of wastewater between facilities. It assumes that the discharge permit limits for metals in Mule Gulch NPDES permit can be increased or that the rehabilitation of the sewer mains reduces the metals entering the WWTP such that Mule Gulch is granted an APP by the state and the Finding of Violation is resolved. If that occurs, the WWTP can continue to discharge into Mule Gulch.

Due to the limited space available, major expansion or renovation of the Mule Gulch WWTP to meet existing and future treatment needs is not possible. Under Alternative 1, the existing treatment equipment and infrastructure at the Mule Gulch WWTP would be repaired or replaced as needed. The facility would continue to discharge effluent to the Mule Gulch arroyo. The Mule Gulch WWTP would continue to have a design treatment capacity of 230,000 gpd. To adequately treat wastewater influent flows during peak periods that would exceed the capacity of the Mule Gulch a connection to convey excess influent flows to the Warren WWTP for treatment would be required. This connection would consist of a new lift station at the Mule Gulch WWTP and a new force main that ties into an existing Warren interceptor to convey excess wastewater flows to the Warren WWTP.

Under Alternative 1, the existing Warren WWTP would treat all flows from the Warren area and excess flows from Mule Gulch during peak periods. The following improvements to the Warren WWTP would occur:

- Reconstruction of three original lagoons

- Construction of new wetlands for additional effluent treatment
- Construction of an effluent reuse storage pond
- Construction of an ultraviolet disinfection system
- Expansion of the existing land application area for effluent disposal

The current capacity of the Warren WWTP is 390,000 gpd. This capacity is assumed to be sufficient because the majority of the I/I flow peaks would be removed with the rehabilitation of the sewer lines. No additional land for treatment lagoons would be required, however an additional 63 acres would be required to be added to the existing 40-acre land application area for effluent handling and disposal.

The following improvements to the San Jose WWTP would occur under this alternative:

- Construction of 3rd lagoon
- Construction of an ultraviolet disinfection system
- Construction of a conveyance pipe to the Turquoise Valley Golf Course for disposal of reclaimed water outside of the sulfate plume
- Closure of the existing 11-acre land application site

The design treatment capacity of the San Jose WWTP would be increased to 200,000 gpd by the addition of the third lagoon. An additional 3 acres, available on City property, would be required for the third lagoon. The reclaimed water from the San Jose WWTP would be used for irrigation of the Turquoise Valley Golf Course. The quantity of reclaimed water generated is well below the needs of the golf course and all would be taken up by the golf course.

2.2.3 Alternative 2

Alternative 2 was considered to evaluate the impact of closing the Mule Gulch facility and conveying the Old Bisbee wastewater flows to the Warren WWTP for treatment (Figure 6, Appendix A). It assumes that the use of facultative lagoons continue at both the Warren and San Jose WWTPs, similar to the treatment process described in Alternative 1.

Flows from the Old Bisbee area of the City would be conveyed to the Warren WWTP via a new lift station at the Mule Gulch WWTP and a new force main that ties into an existing Warren interceptor. The existing Mule Gulch WWTP facility would be abandoned in place.

The Warren WWTP would be expanded to treat the influent from the Old Bisbee and Warren areas. Under Alternative 2, the following improvements to the Warren WWTP would occur:

- Reconstruction of three original lagoons
- Construction of two additional lagoons for a total of 6 treatment lagoons
- Construction of new wetlands for additional effluent treatment

- Construction of an ultraviolet disinfection system
- Expansion of the existing land application area for effluent disposal

With the completion of these improvements, the Warren WWTP would have a treatment capacity of 620,000 gpd. An additional 11 acres would be required for the 3 new treatment lagoons and a total of 272 acres, an addition of 232 acres to the 40-acre area currently used, would be required for effluent handling and disposal.

Improvements to the San Jose WWTP would be identical to those proposed under Alternative 1. The following improvements to the San Jose WWTP would occur under this alternative:

- Construction of 3rd lagoon
- Construction of an ultraviolet disinfection system
- Construction of a conveyance pipe to the Turquoise Valley Golf Course for disposal of reclaimed water outside of the sulfate plume
- Closure of the existing 11-acre land application site

The design treatment capacity of the San Jose WWTP would be increased to 200,000 gpd by the addition of the third lagoon. An additional 3 acres, available on City property, would be required for the third lagoon. The reclaimed water from the San Jose WWTP would be used for irrigation of the Turquoise Valley Golf Course. The quantity of reclaimed water generated is well below the needs of the golf course and all would be taken up by the golf course.

2.2.4 Alternative 3

Alternative 3 proposes the removal of the Mule Gulch WWTP from service and the construction of new activated sludge wastewater treatment plants at both the Warren and San Jose WWTPs (Figure 7, Appendix A). Disposal of reclaimed water would be accomplished using the methods described in Alternatives 1 and 2.

Flows from the Old Bisbee area of the City would be conveyed to the Warren WWTP via a new lift station at the Mule Gulch WWTP and a new force main that ties into an existing Warren interceptor as proposed in Alternative 2. The existing Mule Gulch WWTP facility would be abandoned in place.

Under this alternative, the following improvements to the Warren WWTP would occur:

- Construction of a new influent sewer main to plant site
- Construction of an activated sludge treatment plant with nitrification/denitrification, ultraviolet disinfection and clarification
- Conversion of the existing 40-acre land application area to a new high rate surface disposal site to dispose of the reclaimed water
- Construction of operations building, flow monitoring station, and standby generator

With the completion of these improvements, the Warren WWTP would have a treatment capacity of 620,000 gpd. The new WWTP would be constructed on City property adjacent to the existing lagoons. The nitrification/denitrification process to be used at the Warren WWTP would remove the nitrogen from the wastewater

and the resulting effluent quality would allow more effluent per acre to be applied than achieved by the current disposal process thus requiring less surface area. In addition, ADEQ does not require storage ponds when surface disposal is used. Because of the higher quality effluent provided by this alternative, no additional land would need to be acquired to provide for adequate disposal at the new Warren WWTP.

Under Alternative 3, a new activated sludge wastewater treatment plant with a design treatment capacity of 200,000 gpd would be constructed to replace the existing San Jose lagoon treatment system. The following improvements to the San Jose WWTP would occur:

- Remove the existing lagoons from service and close
- Construction of an activated sludge treatment plant with nitrification/denitrification, ultraviolet disinfection and clarification
- Construction of operations building, flow monitoring station, and standby generator
- Construction of a conveyance pipe to the Turquoise Valley Golf Course for disposal of reclaimed water outside of the sulfate plume
- Closure of the existing 11-acre land application site

The new WWTP would be constructed on City property adjacent to the existing lagoons. The reclaimed water from the San Jose WWTP would be used for irrigation of the Turquoise Valley Golf Course. The quantity of reclaimed water generated is well below the needs of the golf course and all would be taken up by the golf course.

2.2 5 Alternative 4

Alternative 4 proposes to close both the Mule Gulch and Warren WWTPs and treating all City wastewater flows at a new facility constructed at the San Jose site (Figure 8, Appendix A).

The Mule Gulch WWTP would be removed from service. Flows from the Old Bisbee area of the City would be conveyed to Warren via a new lift station at the Mule Gulch WWTP and a new force main that ties into an existing Warren interceptor as proposed in Alternatives 2 and 3. The existing Mule Gulch WWTP facility would be abandoned in place.

The Warren WWTP would also be removed from service. Flows from Warren and Old Bisbee would be conveyed to the San Jose WWTP via a new pipeline along Airport Road and across land owned by Phelps Dodge to the existing sewer main in San Jose. The following actions would occur at the Warren WWTP under this Alternative:

- Construct a sewer main connecting the Warren WWTP to the San Jose WWTP
- Take existing lagoons out of service, dry and dispose of solids
- Closure of the existing lagoons and 40-acre land application site

All wastewater flows from the City would be diverted to the San Jose WWTP. To treat this flow, an activated sludge WWTP with both nitrification and denitrification treatment would be built at the San Jose WWTP site, which would provide a quality effluent for surface disposal or reuse. The design capacity of the new treatment plant would be 820,000 gpd. Major improvements to be completed at the San Jose WWTP under Alternative 4 include:

- Construction of an activated sludge treatment plant with nitrification/denitrification, ultraviolet disinfection and clarification

- Conversion of 1 treatment lagoon for emergency storage of wastewater. Abandon the other lagoon in place after construction of new treatment plant, dry and dispose of solids.

- Construction of operations building, flow monitoring station, and standby generator

- Construction of a conveyance pipe to the Turquoise Valley Golf Course and Green Bush Draw for disposal of reclaimed water outside of the sulfate plume

- Closure of the existing 11-acre land application site

The new WWTP would be constructed on City property adjacent to the existing lagoons. Several secondary treatment alternatives are under consideration to provide wastewater treatment in accordance with Arizona Class B+ water quality standards for reuse and to satisfy NPDES permit requirements. Under Class B+ water quality effluent limitations, secondary treatment, disinfection and nitrogen removal are required. All secondary treatment options under consideration will provide adequate quality to meet existing Arizona Class B+ water quality standards and have the ability to be expanded and adapted to meet changing discharge limits. All secondary treatment alternatives considered for this alternative would have the same environmental effects.

In this alternative, the majority of the reclaimed water would be used to irrigate the Turquoise Valley Golf Course. During periods of low irrigation needs, excess water would be placed into Greenbush Draw near the Naco Highway Bridge approximately 0.5 mile south of Purdy Lane.

A new access road to the treatment plant would be constructed under this alternative. The access road would be 1,000 feet long by 25 feet wide and provide access to the site from Purdy Lane to the south. The land that would be traversed by the road is privately held and undeveloped land outside of the City.

2.2.6 Alternatives Comparison

A summary of each alternative under consideration is provided in Table 2. The analysis of alternatives included consideration of the treatment processes proposed and quality parameters required by state and federal regulations, disposal options and general operation and maintenance costs.

Alternative 1 relies on the existing treatment plants and processes to meet the future wastewater needs of the City. This alternative would require extensive and costly upgrades to provide adequate treatment by the 60-year-old Mule Gulch WWTP. The existing Mule Gulch WWTP does not have the design flexibility or available space to meet more restrictive EPA and ADEQ wastewater treatment standards and flow demands that may develop in the future. Metals loading from the plant would continue to have the potential to violate NPDES standards unless the discharge limits for metals from the facility are increased or metals loading from the collection system is adequately reduced. The Warren WWTP would require more land to provide adequate disposal. Reclaimed water from the San Jose WWTP would be conveyed to the Turquoise Valley Golf Course to accomplish disposal outside of the sulfate plume. The City would be required to operate and maintain multiple facilities throughout the City.

Alternative 2 relies on expanded facultative lagoon treatment systems at Warren and San Jose to treat all wastewater. A considerable amount of land would need to be acquired to provide for effluent disposal at the Warren WWTP. A major concern with the disposal area near the Warren WWTP is the potential for large numbers of birds to be drawn to the area in proximity to the Bisbee Airport. Reclaimed water from the San Jose WWTP would be

conveyed to the Turquoise Valley Golf Course to accomplish disposal outside of the sulfate plume. This alternative would also require the City to operate and maintain multiple wastewater treatment facilities.

Alternative 3 relies on new WWTPs at Warren and San Jose using an activated sludge treatment process at both locations. This alternative provides a higher level of treatment than Alternative 1 or 2, thereby allowing a higher land application rate at Warren that will be less land-intensive than the previous options considered. Reclaimed water from the San Jose WWTP would be conveyed to the Turquoise Valley Golf Course to accomplish disposal outside of the sulfate plume. The activated sludge treatment processes also provide for greater flexibility to meet future treatment standards than those proposed under Alternative 1 or 2. This alternative would also require the City to operate and maintain multiple wastewater treatment facilities.

Alternative 4 relies on the same type of treatment as proposed under Alternative 3, but relies on a single WWTP to serve the City's needs. This alternative therefore requires less operation and maintenance costs than Alternative 3 while providing the same high quality discharge. Because the Warren facility is closed, land costs for this alternative are also less than the other action alternatives under consideration. Treatment and disposal away from the Warren area relieve the concern of attracting birds close to the Bisbee Airport. Reclaimed water from the San Jose WWTP would be conveyed to the Turquoise Valley Golf Course and Green Bush Draw to accomplish disposal outside of the sulfate plume.

Table 2. Comparison of Wastewater Treatment Alternatives

Characteristic	Alt 1	Alt 2	Alt 3	Alt 4
Projected Treatment Capacity				
Mule Gulch WWTP	230,000 gpd	Out of service	Out of service	Out of service
Warren WWTP	390,000 gpd	620,000 gpd	620,000 gpd	Out of service
San Jose WWTP	200,000 gpd	200,000 gpd	200,000 gpd	820,000 gpd
City Areas Served				
Mule Gulch WWTP	Old Bisbee	None	None	None
Warren WWTP	Warren & Old Bisbee Excess	Warren & Old Bisbee	Warren & Old Bisbee	None
San Jose WWTP	San Jose	San Jose	San Jose	Entire City
Wastewater Treatment System				
Mule Gulch WWTP	Trickling Filter	Out of service	Out of service	Out of service
Warren WWTP	Lagoons (4) and constructed wetlands	Lagoons (4) and constructed wetlands	Activated Sludge	Out of service
San Jose WWTP	Lagoons (3) and constructed wetlands	Lagoons (3) and constructed wetlands	Activated Sludge	Activated Sludge
Effluent Disposal Method				

Mule Gulch WWTP	Surface Discharge	Inactive	Inactive	Inactive
Warren WWTP	Land application	Land application	Surface Discharge	Inactive
San Jose WWTP	Beneficial Reuse	Beneficial Reuse	Beneficial Reuse	Beneficial Reuse and Surface Discharge

Source: (Wastewater Master Plan Report, City of Bisbee April 2001

Alternative 4 was selected by the City as the preferred alternative for addressing wastewater collection and treatment needs (Figure 9, Appendix A). This alternative provides secondary treatment resulting in high quality discharge, the ability to meet expected future wastewater treatment demand and regulatory treatment standards, the ability to maximize beneficial reuse for disposal of the reclaimed water and reduced overall operation and maintenance costs via centralized facilities. Alternative 4 also had the lowest present worth costs of the action alternatives considered. The proposed improvements included in Alternative 4 (including the collection system rehabilitation) were also directed to be completed by the City under the April 14, 2001 Consent Order agreement with ADEQ.

Section 3 - Affected Environment and Environmental Consequences

3.1 Environmental Assessment Approach

This EA is based on an analysis of the potential effects associated with each of the alternatives (No Action and four action alternatives) for collection/treatment improvements. The EA provides an inventory of the existing natural, socio-economic and cultural environment within the study area and identifies potential environmental impacts associated with the implementation of each alternative.

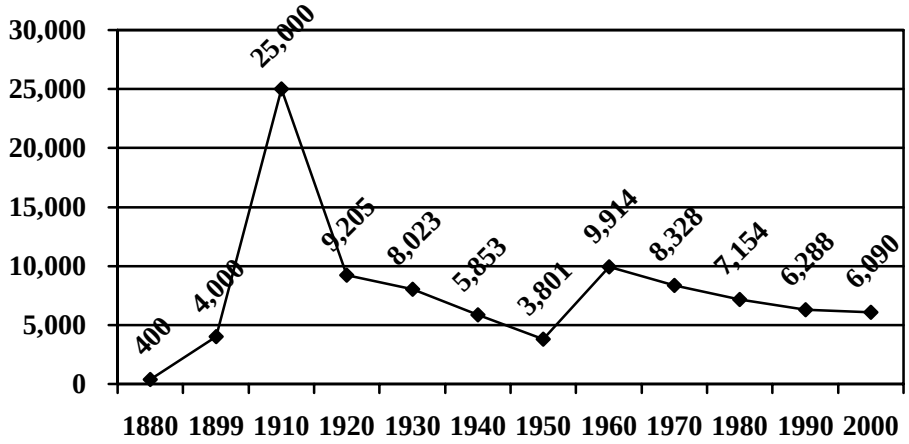
A study area consisting of the city limits of Bisbee, AZ (approximately 5.4 square miles), a one-quarter mile area centered on and extending from each WWTP in the system, and a minimum one mile reach downstream from each proposed wastewater treatment system discharge point was considered in this EA.

3.2 Socio-economics, Environmental Justice and Community Resources

The City has experienced little population growth over the past two decades (Figure 10), however dramatic population changes have been experienced during the 20" century. From its settlement until about 1920, the City was a “boom town” attributable to the large copper mining interests and low level of mining technology which required a large labour force. After about 1920, mining employment opportunities in the City began to decline as technological advances changed the industry. With no other employment opportunities, workers left and the City experienced a dramatic population decrease.

In 1959, the City annexed the Warren and San Jose areas (City of Bisbee 1996). The Warren area was already a developed, thriving community while the San Jose area was a rather new development area. Since that time, the City has exhibited a generally steady population trend, with most of the recent development occurring in the San Jose area. The development of the Old Bisbee area as a tourist destination and enclave for artisans has revitalized this area socially and economically, but has had limited effect on resident population growth in the City. Between 1990 and 2000, the City population decreased 3% while housing units increased 4% (Table 3).

Figure 10. Population Trends, City of Bisbee, Arizona



Sources: Bisbee General Plan 1996, Wastewater Master Plan 2001

Table 3. Population and Housing Units, City of Bisbee Arizona

Characteristic	1990	2000	% Change
Population	6,288	6,090	-3.1%
Total Housing Units	3,181	3,316	4.2%
Occupied Housing Units	2,664	2,810	5.5%
Vacant Housing Units	517	506	-2.1%

Source. US. Bureau of the Census, 1990 and 2000 U.S. Census

Population projections indicate slow and steady growth for Bisbee over the next several decades (Table 4). This represents an average annual growth rate of less than 1% for the City. Due to the natural features of the area, the specialized economy, and the amount of land held in private ownership which is not planned for development and not open to annexation, the future land use and population of the Bisbee area are likely to remain much as it is today. Unless mining interests resume significant exploration in the area, little change in the character of the City is projected. Any additional growth would likely occur in the San Jose area where some undeveloped land suitable for development is available. The Old Bisbee and Warren areas are effectively "built-out" with little to no room for expansion.

Table 4. Population Projections, City of Bisbee, Arizona

Projection Year	Projected Resident Population	Change from 2000 Population
2010	6,641	9%
2020	6,692	10%

2030	6,788	11.5%
2040	6,856	12.5

Source: Arizona Department of Economic Security

The US/Mexico border area is one of the poorest regions in the state of Arizona. Per capita income and median household income for the City and Cochise County are well below the levels of the state of Arizona (Table 5). Poverty levels in the City also generally outpace those of Cochise County and the state.

Table 5. Income and Poverty Characteristics, City of Bisbee, Arizona

Characteristic	City of Bisbee	Cochise County	State of Arizona
1989 Per Capita Income	$9,530	$10,716	$13,461
1999 Per Capita Income	$17,129	$15,988	$20,275
1989 Median Household Income	$17,583	$22,425	$27,540
1999 Median Household Income	$27,942	$32,105	$40,558
1989 % of Individuals living below poverty level	21.5%	19.2%	15.4%
1999 % of Individuals living below poverty level	17.5%	17.7%	13. 9%

Source: U.S. Bureau of the Census, l990 and 2000 Census

Employment in Bisbee today is almost exclusively in the retail trade, public administration and educational, health and social services sectors. The City benefits from governmental employment related to City and Cochise County government and health and educational employment related to the local school district and hospital. The tourism industry in Bisbee provides many retail and service oriented employment opportunities, however many of these jobs are seasonal in nature and generally have low wage rates. Approximately 500 business licenses are issued in Bisbee (City of Bisbee 1996). Many of the businesses in Old Bisbee support the tourism and arts/crafts industry. The City is also an attractive living option for retired individuals. Unemployment rates from the 2000 Census show that approximately 4.4% of the available labor force (population over age 16) was unemployed, in comparison to an unemployment rate of 3.4% for Cochise County and the state of Arizona. The major reason for this difference is related to the higher percentage of persons over age 62 in the City, many of whom are retired from the work force.

According to the 2000 U.S. Census, approximately 34% of the City population identify themselves as belonging to either the Hispanic or Latino race. The City has experienced an increase in minority population since 1990 (Table 6), but its population is still predominantly comprised of white residents.

Table 6. Racial Characteristics, City of Bisbee, Arizona

Population	1990	% of 1990 Population	2000	% of 1990 Population	% Change in Population 1990-2000
Total Population	6,288	100%	6,090	100%	-3.1%
White	5,945	94.5%	5,123	84.2%	-13.8%
Black or African American	16	0.3%	28	0.5%	75%
American Indian or Alaska Native	81	1.3%	74	1.2%	-8.6%
Asian			30	0.5%	na
Native Hawaiian and other Pacific Islander	31*	0.5%	4	>0.1%	na
Some other race	215	3.4%	674	11.0%	213.5%
Two or more races	Not reported	---	157	2.6%	na

**Asian, Native Hawaiian and other Pacific Islander groups were not separately counted in 1990 Census*
Source: U.S. Bureau of Census, 1990 and 2000 Census

No Action Alternative

The No Action alternative would generate adverse impacts upon the socio-economic resources of the City. With a lack of adequate infrastructure and continued limits on growth imposed by the Consent Order, little to no growth would occur within the City. In concert with ongoing fines imposed on the City and the inability to attract an additional tax base, the economic impact upon the City and its citizens would be considerable. Economic concerns could impact area businesses and adversely affect the tourism industry that accounts for a substantial part of the area employment. This impact would be mitigated through implementation of any of the 4 action alternatives.

Alternatives 1, 2, 3 and 4

Alternatives 1, 2, 3 and 4 would have similar impacts upon the socio-economic characteristics of the City. Implementation of any of the collection/treatment system improvements would allow the growth moratorium to be lifted and allow new development to occur. Lifting of the moratorium is not expected to greatly influence future population growth rates because of the physical and economic limitations the City's location provides, but would allow for continued infill development.

With improved infrastructure and removal of the moratorium, secondary economic development could occur to increase the tax base. While all of the action alternatives will result in tax or user fee increases to the citizens, the burden from these improvements is likely to collectively be less than the potential economic dilemma posed by the No Action alternative. Alternative 4, the preferred alternative, would generate the least socio-economic impact on the City by being the lowest cost alternative and one that provides the flexibility to meet future wastewater

treatment demands and state and federal discharge limitations. This alternative will help the City to avoid further major expenses to provide for adequate wastewater treatment in the future.

Executive Order 1-898 on Environmental Justice requires Federal agencies to assess the impacts of their actions on minority and low-income populations. No specific populations of minority or low-income populations have been identified in the City. Each of the action alternatives would provide benefit to the entire population of the City, regardless of race or financial status. Implementation of Alternative 4 would generate the lowest overall cost to the City and, theoretically, generate the smallest tax or user fee increases to all residents.

3.3 Land Use and Community Resources

The City of Bisbee is located in the extreme southeastern portion of Cochise County, approximately four miles north of the international border with the Sonoran Sate of Mexico. The City is geographically composed of three separate areas: Old Bisbee, Warren, and San Jose. The majority of undeveloped land within the City limits and county-controlled land surrounding the City is owned by the Phelps Dodge Company.

Old Bisbee contains the historical setting of the original mining community that began around 1880 and flourished as a mining center through the first two decades of the twentieth century. Around 1900, Bisbee was the largest city between Saint Louis and San Francisco, with a population of more than 20,000 (Arizona Department of Commerce 1998). The core of Old Bisbee is a dense mixture of contiguous commercial buildings pressed together along several narrow streets (City of Bisbee 1996). A variety of institutional uses, including, government, educational, and religious structures are adjacent to the central business district. Residential uses are scattered around the core area on the surrounding hillsides.

The Warren area was developed following the "City Beautiful" movement of the early 1900s (City of Bisbee 1996). The area contains a more suburban environment than Old Bisbee, with neighborhood parks, a broader grid street system, and uniformity in lot sizes and housing types. The Warren area contains Bisbee's City Hall and other City offices, and hosts the Copper Queen Hospital and a variety of commercial and business establishments. The Warren area was annexed into the City in 1959.

The San Jose area, the most recently developed area of the city, began after World War 11 as a housing area resulting from the increased demand for mining workers. The San Jose area was annexed by the City in 1959. Today the area is a mixture of residential uses, institutional uses, and a number of highway commercial uses that serve both San Jose and the City.

Future development in the City is predominantly planned for the San Jose area. Development projected to occur in the San Jose area includes additional single-family residences as extensions of existing neighborhoods, the potential development of a small apartment complex for senior citizens and additional commercial development. Limited infill development is projected to potentially occur in the Old Bisbee and Warren area where vacant or under-utilized lands are available. However, since wastewater treatment capacity is increasing only slightly over current needs and a number of existing private septic systems are projected to connect to the public system, the proposed improvements will not generate the potential for substantial secondary development within the City.

The City provides a full range of community services to its citizens, including educational and library services, emergency services (including fire, police and ambulance services), waste services, and water and sewer services. The City maintains 11 neighborhood parks and various recreation programs for youth and adults. The City also provides limited bus service to provide an alternative transportation option for City residents. The Bisbee Municipal Airport is operated by an independent operator with oversight from the City's Public Works Department.

No Action Alternative

Land use characteristics under the No Action alternative would not substantially change. The continuation of the moratorium would generally eliminate any changes in land use or additional development throughout the City.

Alternative 1

Under this alternative, an additional 63 acres would be required at the Warren WWTP to provide for adequate effluent handling and disposal. All of the area that would be used to accomplish this is privately held, undeveloped land immediately adjacent to the existing wastewater treatment facilities.

At the San Jose WWTP, approximately 9 acres for a new lagoon and storage pond would be required. All of this land is undeveloped land owned by the City and is immediately adjacent to the existing wastewater treatment facilities. The alternative also requires installation of a new discharge line from the San Jose Plant. The San Jose discharge line would be the same as described in Alternative 1 and the existing 11-acre land application area would be closed.

Alternative 1 would limit future infill development in the Old Bisbee section of the City because of the limited ability of the Mule Gulch WWTP to adequately treat wastewater demand. Limited future development in other areas of the City currently projected for development could occur.

Alternative 2

At the Warren WWTP, an additional 243 acres (11 acres for new lagoons, 23 acres for a new storage pond and 209 additional acres for effluent disposal) would be needed. As in Alternative 1, all of the areas identified for use are privately held, undeveloped lands outside of the City and are immediately adjacent to the existing wastewater treatment facilities.

Land use associated with improvements at the San Jose WWTP would be identical to those under Alternative 1. Approximately 9 acres for a new lagoon and storage pond would be required. All of the areas identified for use are privately held, undeveloped lands outside of the City and adjacent to the existing wastewater treatment facilities. The San Jose discharge line would be the same as described in Alternative 1 and the existing 11-acre land application area would be closed.

Alternative 3

Land use impacts under Alternative 3 would be minimal since no additional land is needed to construct the new WWTPs and the existing 40-acre disposal area at the Warren WWTP is adequate for the new facility. The San Jose discharge line would be the same as described in Alternative 1.

Alternative 4

Under this alternative, approximately 10 acres of undeveloped land would be needed for the discharge conveyance pipe between Warren and San Jose and approximately 20 acres of additional land at the San Jose site would be required to provide for mandated treatment facility setbacks. The new access road would require less than 1 acre. The San Jose discharge line would be the same as described in Alternative 1 and the existing 11-acre land application area would be closed. All areas identified for these needs are privately held, undeveloped lands outside of the City.

3.4 Topography, Geology and Soils

Bisbee is in the Basin and Range physiographic province of Arizona, characterized by low rugged mountains surrounded by valleys. Elevations in the Bisbee area range from about 6,000 feet in the Mule Mountains around Old Bisbee to 4,800 feet above sea level along the Espinal Plain to the south of San Jose.

The Mule Mountains are a complex assemblage of faulted igneous, metamorphic and sedimentary rocks (Littin 1987), composed of Precambrian to Tertiary formations. The Mule Mountains contain abundant quantities of copper that served as the impetus for the development of mining interests in the area and the formation of Bisbee in the late 1800s. They also have quantities of lead, zinc, manganese, gold and silver. Commercial development of these ores was the primary economic base for the Bisbee area for approximately 100 years. More than eight billion pounds of copper and three million ounces of gold were mined from 1880 to 1981 (Bisbee General Plan 1996).

In the plains area south of Old Bisbee, alluvial deposits of Quaternary and Tertiary sedimentary deposits are comprised of conglomerates, gravel, sand, silt and clay up to 270 feet in thickness (Littin 1987).

In the Old Bisbee and Warren areas, soils are primarily shallow soils over limestone, shale, sandstone, and granite. These soils are well-drained, gravelly or rocky, and moderately coarse and medium textured. In the San Jose area, soils are shallow alluvial deposits derived from granite and sandstone that exhibit moderate permeability.

Three distinct soils associations are found in the Bisbee area: the Bakersville-Gaddes association, the Tortugas association, and the Kimbrough-Cave association. The Bakersville-Gaddes association is described as very shallow to moderately deep, steep to very steep, cobbly and gravelly, medium to moderately fine textured soils over granite. The Tortugas association is defined as shallow to very shallow, dark colored, steep to very steep, cobbly and stony loams over limestone. The Kimbrough-Cave association is described as shallow, well-drained, nearly level to moderately steep, medium-textured soils over a lime-centered hardpan (City of Bisbee 1996).

No Action Alternative

No impact to geology and soils would occur under the No Action alternative.

Alternative 1

Under Alternative 1, construction activities would generate small changes in topography through the development of additional lagoons, storage ponds and the placement of the San Jose discharge pipe to the Golf Course. Approximately 9 acres at the Warren WWTP and approximately 9 acres at the San Jose WWTP would be impacted from the construction of additional treatment lagoons and storage ponds. Soils would have an increased susceptibility to erosion during construction activities, but this effect would be minimized through the use of erosion control measures and where necessary, revegetation of disturbed areas upon the completion of construction. Topography, geology and soils would not be adversely affected by any of the effluent disposal methods considered by any alternative.

Alternative 2

Impacts of Alternative 2 on topography, geology and soils would be similar to those experienced under Alternative 1, but would occur over a larger area. Approximately 34 acres at the Warren WWTP and approximately 9 acres at the San Jose WWTP would be impacted from the construction of additional treatment lagoons and storage ponds.

Alternative 3

Impact of Alternative 3 on topography, geology and soils would be similar to those experienced under Alternatives 1 and 2, except that less soil disturbance would occur because no lagoons or storage ponds would be constructed. Soil impacts of this alternative would generally be related to construction of the new WWTPs at Warren and San Jose on previously disturbed areas.

Alternative 4

Impacts to topography, geology and soils under Alternative 4 would be similar to Alternative 3, with less disturbance from construction of the WWTP (one plant versus two) but slightly more disturbance from the placement of the pipeline from Warren to San Jose.

3.5 Climate and Air Quality

The climate of the region is arid to semiarid, and characterized by warm summers and moderate winters. The City experiences a smaller range of temperatures than the surrounding areas due to the influence of the mountain elevation. The precipitation for the area varies considerably from month-to-month, and especially from year-to-year. About 50 to 60 percent of rainfall occurs during the monsoon season (July through September) with the remainder falling, during the winter months as a result of large cyclonic storms. The driest months are generally April, May, and June. Average annual precipitation in Bisbee is 16.2 inches. The annual mean temperature of Bisbee is 60^{o} F. The average daily maximum and minimum temperatures are 74.5^{o} F and 48.7^{o} F, respectively.

The City is an attainment area for all Federal air quality standards (U.S. Environmental Protection Agency, 2002). The prevailing winds, high altitude, and low population have each contributed to local air quality. The closing of the majority of the mining operations, especially copper smelters, has contributed greatly to the improvement of air quality in Bisbee since the turn of the century. Today, there is limited mining activity or other industrial/manufacturing activities that adversely influence local air quality. The WWTPs, especially those at Warren and San Jose, generate offensive odors inherent to the treatment of wastewater. Odors at Warren and San Jose are attributable to exposed solids in poorly maintained lagoons and anaerobic conditions from algal activity and winter turn-over of lagoon waters. Anaerobic conditions generate elevated levels of hydrogen sulfide at the lagoon sites, resulting in offensive odors.

No Action Alternative

The No Action alternative would have no impact on climate and air quality.

Alternatives 1, 2, 3 and 4

Under Alternatives 1, 2, 3 and 4, no permanent impacts on climate and air quality would occur. Under Alternatives 1 and 2, lagoon systems would continue to be used to treat wastewater and these facilities would continue to generate some offensive odors, but due to their remote location this impact would not adversely affect residential areas or other areas of human activity. Construction activities would have a temporary effect by generating dust and increasing particulate matter emissions. Use of construction equipment would also create dust and contribute diesel exhaust to ambient air quality. During collection system work, these impacts would temporarily disturb normal activities within populated areas of the City. Collection system improvements will be staged to limit disturbance during peak periods of tourist activity and civic events, especially in the Old Bisbee area. Because of the remote location of the treatment plant sites, construction-related activities will not create observable air quality impacts.

3.6 Noise

Noise levels in the City are typica1 of a small urban community. Passenger and commercial vehicles using City streets and state highways are the largest source of ambient noise. Industrial and mining activities contribute a minor portion of ambient noise. The existing wastewater treatment facilities are located in remote, rural locations and do not generate a substantial amount of noise. The Bisbee Airport is located outside of the City limits in a remote area and does not generally contribute to noise conditions in Bisbee.

No Action Alternative

The No Action alternative will not affect existing noise levels within the study area.

Alternatives 1 and 2

No permanent noise impacts would occur under Alternatives 1 and 2. Collection system improvements would generate typical construction noise in various residential and commercial areas at temporary durations over a 10-year period. Collection system improvements would be staged to limit disturbance during peak periods of tourist activity and civic events, especially in the Old Bisbee area.

Expansion of the treatment facilities described under these alternatives would generate noise impacts related to construction activities such as the use of air or fuel powered equipment and operation of construction vehicles. However, the treatment facilities are not located in areas of sensitive receptors, such as residential, commercial or institutional land users, and no substantial impacts to residents or businesses would occur. The gravity-fed lagoon treatment process continues under these alternatives and no noise will be generated by the operations after construction is completed.

Alternative 3

Collection system improvements would generate typical construction noise in various residential and commercial areas at temporary durations over a 10-year period. Collection system improvements would be staged to limit disturbance during peak periods of tourist activity and civic events, especially in the Old Bisbee area.

Construction of the new treatment facilities described under this alternative would generate noise impacts related to construction activities such as the use of air or fuel powered equipment and operation of construction vehicles. However, the treatment facilities are not located in areas of sensitive receptors, such as residential, commercial or institutional land users, and no substantial impacts to residents or businesses would occur.

The new activated sludge treatment process implemented under this alternative requires the use of operating equipment such as pumps and air blowers and ongoing noise would be generated by the operation. This alternative results in two separate locations of noise generation, the first at the Warren plant site and the second at the San Jose plant site. Noise levels can be reduced through engineered means such as enclosures or sound baffles and employing facility setbacks from the property boundary.

Alternative 4

Collection system improvements would generate typical construction noise in various residential and commercial areas at temporary durations over a 10-year period. Collection system improvements would be staged to limit disturbance during peak periods of tourist activity and civic events, especially in the Old Bisbee area.

Construction of the new San Jose treatment facility and closure of the Warren facility described under this alternative would generate noise impacts related to construction activities such as the use of air or fuel powered equipment and operation of construction vehicles. However, the treatment facilities are not located in areas of sensitive receptors, such as residential, commercial or institutional land users, and no substantial impacts to residents or businesses would occur.

The new activated sludge treatment process implemented under this alternative requires the use of operating equipment such as pumps and air blowers and ongoing noise will be generated by the operation. This alternative results in one location of noise generation, the San Jose plant site. Noise levels can be reduced through engineered means such as enclosures or sound baffles and employing facility setbacks from the property boundary.

3.7 Solid and Hazardous Wastes

Domestic and commercial solid waste collection services are provided by the City. Wastes from the City are disposed of at the Cochise County Western Regional Landfill. Four recycling drop-off stations are located in the City and accept aluminum cans and paper products (newspaper, magazines, white paper and cardboard). A local county-operated transfer station accepts tires, batteries, used oil, appliances and yard waste in addition to aluminum and paper recyclables. No hazardous waste generators or disposal sites are located within the study area.

Dried solids from the existing Mule Gulch WWTP are collected by the City and disposed of at the Cochise County Western Regional Landfill. The treatment lagoons at the Warren and San Jose WWTPs contain solids that have accumulated over the past several years.

No Action Alternative

The No Action alternative would have no impact on solid and hazardous waste. Solids removed from any of the treatment facilities would continue to be disposed of at the Western Regional landfill.

Alternatives 1, 2, 3 and 4

Each of the action alternatives includes the cleaning and disposal of solids from the Warren and San Jose WWTPS. This material would be characterized and buried in-place if surface disposal requirements are met or taken to the Western Regional landfill for disposal.

Alternatives 3 and 4 would also generate a slightly greater amount of solids on an ongoing basis through the use of activated sludge wastewater treatment processes. All solids generated under these alternatives are proposed to be disposed of at the Western Regional landfill.

3.8 Energy

Natural gas and electric services are provided to the City by Southwest Gas Company and Arizona Public Service, respectively. The Mulch Gulch WWTP is provided with electric service, however neither the Warren nor San Jose WWTPs have electrical service. Available electric service to the Warren and San Jose WWTPs is 1.5 miles and 0.7 miles, respectively, from the current plant sites.

No Action Alternative

The No Action alternative would have no effect on energy requirements or energy use of the existing WWTPS.

Alternatives 1, 2, 3 and 4

Under Alternatives 1, 2 and 3 electrical power would be extended to serve the Warren and San Jose WWTPs to power flow meters, pumps and operations buildings. Under Alternative 4, power would be extended to only the San Jose WWTP to power the new activated sludge plant.

Each of the activated sludge treatment options under consideration for Alternative 4 has similar power requirements. For example, the Aero-Mod SEQUOX^{TM} would require approximately 2,400 kilowatt-hours of electricity per day, while the Extended Aeration Activated Sludge system would require approximately 2,340 kilowatt-hours of electricity per day.

Alternatives 2, 3 and 4 provide for closing the Mule Gulch WWTP and installing a lift station at the site to pump wastewater to Warren. This trade off will reduce power needs at the Mule Gulch site by approximately 5,000 kilowatt-hours per month.

3.9 Water Resources

3.9.1 Surface Waters

No natural perennial surface waters or jurisdictional wetlands exist within the study area. The surface waters in the study area are ephemeral streams, a number of ponds developed as a result of mining activities, and wastewater treatment lagoons associated with the Warren and San Jose WWTPS.

The Mule Gulch arroyo receives discharge from the Mule Gulch WWTP. Flow is ephemeral above the WWTP discharge and generally continuous but low volume at and immediately below the discharge point. Flow below the WWTP is generally 1.0 to 3.0 feet in width and 2.0 to 6.0 inches in depth. The flow characteristics are due to the influence of discharge from the WWTP and waters received from storm water runoff from Old Bisbee. Mule Gulch is defined as effluent-dependent water [Arizona Administrative Code Title 18, Chapter 18, Section 113] indicating that the majority of the water that flows is effluent derived from a wastewater treatment plant. Effluent-dependent water is surface water that, without the discharge of treated wastewater, would be ephemeral water. Downstream from the discharge point, the arroyo supports a rather dense layer of riparian vegetation that is used for local cattle grazing.

Greenbush Draw originates southeast of San Jose and runs northwesterly along the northern edge of the Town of Naco before discharging into the San Pedro River. Several unnamed tributaries of Greenbush Draw flow from north to south across portions of the study area. Annual surface discharge from Greenbush Draw to the San Pedro River is estimated to be 2,600 acre-feet, with approximately 900 acre-feet originating north of the U.S./Mexico border (Littin 1987). Data from a U.S. Geological Survey stream gage indicates that, on average, Greenbush Draw only has observable flow during the months between June and October, which is generally consistent with the period of major climatic precipitation in the area (U.S. Geological Survey, 2002).

Because of the mountainous topography, much of Old Bisbee is within the 100-year floodplain. The Mule Gulch WWTP lies within the 100-year floodplain associated with the Mule Gulch arroyo. Floodwaters from Old Bisbee are collected and transmitted via several smaller culverts that lead to a large concrete culvert that follows Tombstone Canyon through town to the Mule Gulch arroyo. Construction of the culvert began in the 1910s and continued to be expanded and rebuilt during the Works Project Administration program in the 1930s. Floodwaters in the Warren and San Jose areas are collected through culverts and transmitted to detention areas.

3.9.2 Groundwater Resources

Groundwater in the Bisbee area is primarily influenced by the amount of precipitation the area receives and the amount of water that can be derived from underground stores.

The water table in the Bisbee area ranges from 10 to 200 feet below the surface. Springs and streams in the Bisbee area tend to be ephemeral and flow only during and immediately following substantial rainstorm events. In 1985, total groundwater withdrawals from the aquifer in the Bisbee-Naco area for domestic purposes were approximately 2,200 acre-feet from several private water companies (Littin 1987).

Potable water service to the City is provided via wells through the Arizona Water Company from company wells located west of Naco, Arizona. Based on winter water usage rates (which include minimal irrigation demand and therefore provide the best estimate of potable water needs), the City uses approximately 645,700 gallons of potable water per day. Recent water quality sampling indicates that the water supplied by the Arizona Water Company meets all state and federal drinking water standards (Arizona Water Company, 2002), although a history of septic tank and leach field failures in the San Jose and Naco areas do present potential health hazards. Furthermore, water mains and valves share sewer system manholes in Warren and contribute to the potential for contamination of potable water and raw groundwater supplies.

A sulfate plume has been identified in the upper water table in the area surrounding the San Jose WWTP. The plume is the result of dewatering efforts associated with mining activities that occurred between 1904 and 1985. The immediate source of contamination is the mine water evaporation pond that was located south of the Phelps Dodge Tailings impoundment and west of the Warren WWTP. Use of the evaporation pond stopped in 1985 when mine dewatering efforts ended and the area has been reclaimed. The National Secondary Drinking Water standards under the Safe Drinking Water Act set a maximum contaminant level for sulfate of 250 mg/1 [40 CFR Part 1431. Groundwater monitoring within and adjacent to the plume has occurred since 1988. At the center of the plume north and west of the San Jose WWTP, sulfate concentrations have been measured above 2000 mg/1. Elevated levels of sulfate extend to south of Purdy Lane, where sulfate concentrations above 250 mg/1 have been measured (Phelps Dodge 1998). Modeling efforts completed by Phelps Dodge Mining Co. indicate the plume is expected to slightly extend to the southwest over the next 50 years (Figure 11 and Figure 12, Appendix A). The model of the plume did not include an analysis of hydraulic loading to the plume. However, it is reasonable to assume that recharge to the aquifer within the plume boundary has the potential to influence plume migration. Each alternative presented in the April 2000 Wastewater Master Plan includes the potential to pipe reclaimed water from the San Jose Wastewater Treatment Plant to the Turquoise Valley Golf Course or some other reuse/disposal area outside of the plume boundary. To insure a negative impact to the sulfate plume does not occur as a result of this project, land application or surface disposal within the area encompassed by the long-term plume boundary is not considered for any of the action alternatives.

The evaluation of impacts to surface and groundwater completed for this assessment was completed in accordance with Arizona Department of Environmental Quality (ADEQ) Aquifer Protection Permit Program and Arizona Pollutant Discharge Elimination System permitting requirements.

No Action Alternative

The No Action alternative would have an adverse impact on surface and groundwater resources in the study area. Violations of state and federal water quality standards and regulations would likely continue to occur. The potential for continued discharge of effluent high in metals concentration and the continued periodic discharges of untreated wastewater during peak period from the Mule Gulch WWTP would continue to threaten water quality in the Mule Gulch arroyo. The operation of the Mule Gulch WWTP within the 100-year floodplain increases the potential for overloading the capacity of the plant during storm events. Similar discharges of untreated wastewater from the Warren WWTP would continue to threaten water quality of Greenbush Draw. Exfiltration of untreated wastewater from leaking or broken collection pipes and the land application of poor quality effluent from the Warren and San Jose WWTPs would continue to affect local groundwater quality. Use of the San Jose land application area for disposal of reclaimed water from the facility would continue recharge of the aquifer in the area of the sulfate plume, a condition that can influence the migration of the plume. This condition can be addressed by relocating the discharge from the San Jose Facility to an area outside of the plume boundary.

Alternative 1

Alternative 1 results in a number of water-related concerns. The Mule Gulch WWTP would likely continue to discharge effluent with high metals content into the Mule Gulch arroyo. The position of the Mule Gulch WWTP within a floodplain would continue to increase the potential for release of untreated wastewater during storm events. The continued use of lagoons and wetland treatment systems provides a sufficient, but often, unreliable treatment quality. No negative impact on the sulfate plume would occur with this alternative as all discharge points are outside of the long-term plume boundary.

Alternative 2

Effects of Alternative 2 would be similar to those of Alternative 1, with the exception of the elimination of the discharge to Mule Gulch arroyo. The elimination of effluent flow into Mule Gulch would permanently change the character of the arroyo downstream of the Mule Gulch WWTP. Mule Gulch would not longer be classified as an

effluent-dependent water. Much of the existing riparian vegetation would likely not survive without the effluent flow. This would likely eliminate the use of this area for cattle grazing. Although water quantity would be reduced in Mule Gulch, Alternative 2 would benefit the water quality in Mule Gulch by removing sometimes poorly treated wastewater discharge with high metals content and removing the effects on water quality derived from animal waste pollution. The continued use of lagoons and wetland treatment systems provides a sufficient, but often, unreliable treatment quality. No negative impact on the sulfate plume would occur with this alternative as all discharge points are outside of the long-term plume boundary.

Alternative 3

The effects on water resources of Alternative 3 are less than those associated with Alternatives 1 and 2. The use of an activated sludge treatment process will produce a higher quality and more consistent wastewater treatment than the lagoon/wetland systems proposed under Alternatives 1 and 2. Alternative 3 would eliminate the existing surface waters associated with the current lagoon systems at Warren and San Jose, but the elimination of these created surface waters would not be a substantial impact.

No negative impact on the sulfate plume would occur with this alternative as all discharge points are outside of the long-term plume boundary.

Alternative 4

Implementation of Alternative 4 would meet all state and federal wastewater treatment and disposal requirements and produce a high quality effluent while minimizing the potential for influencing the sulfate plume near the San Jose WWTP.

The operation of the WWTP and disposal and/or reuse of the reclaimed water require an Aquifer Protection Permit (APP), Arizona Pollutant Discharge Elimination System (AZPDES) permit, and a Type 2 Reclaimed Water Reuse General Permit. These permits are issued and administered by Arizona Department of Environmental Quality (ADEQ) and require protection of the aquifer and surface water through strict adherence to state and federal rules. The WWTP is considered a categorical discharging facility as defined under Arizona Revised Statute (A.R.S.) 49-241.B.10 and therefore must obtain an APP prior to commencing operation. In order to obtain an APP, it must be demonstrated that the WWTP will be designed, constructed, and operated as to ensure the greatest degree of discharge reduction achievable through the application of the best available demonstrated control technology (BADCT), processes, operating methods, or other alternatives. Furthermore, it must be demonstrated that the discharge from the facility will not cause or contribute to a violation of an aquifer water quality standard at the applicable point of compliance (POC), or further degrade aquifer water quality in the event an aquifer water quality standard is already exceeded at the POC. In order to demonstrate that there will be no impacts as a result of discharge, WWTPs are required to establish a discharge impact area (DIA) and evaluate water quality impacts within that area.

The DIA is defined as the "potential aerial extent of pollutant migration, as projected on the land surface, as a result of a discharge from a facility" (ARS 49-201). Typically, the DIA extent is considered the point at which the pollutant, because of dilution, dispersion, adsorption or degradation, reaches a level that is indistinguishable from ambient conditions. The DIA assessment includes evaluating hydrogeologic conditions, downgradient uses of groundwater, and existing water quality. Because ADEQ uses the DIA assessment to establish permit conditions, i.e. alert levels, monitoring requirements, and operational controls, the assessment must also consider impacts to any existing contaminant plumes within the DIA.

The proposed San Jose WWTP outfall is located in the Greenbush Draw, at the Naco Highway Bridge, north of Naco, Arizona. The Turquoise Valley Golf Course is located approximately 500 feet downstream of the discharge point. The Golf Course has three irrigation wells that currently pump 577 acre feet per year (AF/yr) to meet turf irrigation demands. High demand occurs during the summer months with a peak water use of

approximately 800,000 gallons per day (gpd). The Arizona Water Company Bisbee well field is located approximately 8,000 feet downstream of the discharge point and pumps approximately 1.3 million gallons per day (SET 1998). No other major water users are identified downgradient of the outfall, within the DIA.

To assess water quality conditions within the DIA relative to the basin fill aquifer, Brown and Caldwell collected a groundwater sample from the north irrigation well at the Turquoise Valley Golf Course (ADWR Registration No. 55-568875). The irrigation well is located downgradient (approximately 2,000 feet northwest) of the proposed discharge outfall in Greenbush Draw, and is located upgradient (approximately 6,000 feet east) of the Arizona Water Company Bisbee wellfield. The irrigation well was installed in 1998 and consists of 8-inch diameter steel casing that is screened from 166 to 320 feet below land surface (bls). Depth to water in the well is approximately 140 feet bls.

The water quality sample was collected on January 22, 2003, and submitted to Legend Technical Services of Arizona, Inc., for analysis of various inorganics, priority pollutant metals, and coliform bacteria using chain-of-custody procedures. The final laboratory analysis report is presented in Appendix C. Prior to collecting the water sample, the irrigation well was pumped at a rate of approximately 365 gallons per minute until approximately 9 wellbore volumes were purged.

The water quality results for the irrigation well at Turquoise Valley Golf Course are presented in Appendix C and are considered to be representative of the basin fill aquifer. Nitrate concentrations were reported at 3.9 milligrams per liter (mg/l) and total dissolved solids (TDS) were reported at 300 mg/l. These values compare readily with the nitrate and TDS concentrations reported by Littin (1987) for the native groundwater in the saturated basin fill, which were reported at 2 to 7 mg/l for nitrate and 230 to 360 mg/l for TDS. In addition, the golf course irrigation well reported a low sulfate concentration of 25.8 mg/l, and no detections of Coliform bacteria.

Groundwater recharge for the basin fill aquifer within the Bisbee-Naco area can be divided into three main sources. Groundwater enters the subsurface through fractures and faults within the mountains north of Greenbush Draw (Littin, 1987) and through infiltration from washes and drainages, surface water impoundments, and irrigated lands within the basin (Littin, 1987 and SET, 1998). Groundwater is also derived from mountain-front recharge from the Sierra San Jose Mountains located in the southern portion of the basin near Mexico (Littin, 1987). While the inflows identified by Littin (1987) for the basin fill aquifer are not all inclusive, SET (1998) used that study to define a water budget for a groundwater model prepared for Phelps Dodge in support of an APP application for their Concentrator Tailings Storage Area (CTSA). Information compiled by SET (1998) suggests that inflows into the basin fill aquifer in the Bisbee-Naco area total approximately 7,900 AF/yr.

Groundwater flow in the Bisbee-Naco area typically mimics the direction of surface water drainage. To the north of Greenbush Draw, the principle direction of groundwater flow is towards the southwest. To the south of the discharge location, groundwater flow is towards the northwest (Littin, 1987). Both directions of flow converge near Greenbush Draw, thus producing the resultant westward direction of groundwater flow near the proposed discharge location (Littin, 1987).

A stream flow routing analysis was performed by Brown and Caldwell to estimate the volume of infiltration from Greenbush Draw into the underlying basin fill aquifer. The flow routing analysis also allowed an estimation of the portion of Greenbush Draw likely to be recharging effluent into the basin fill aquifer and a calculation of the percentage of total basin inflows. A modified form of Manning's equation was used in the analysis, which required evaluating streambed morphology and lithology, collecting stream channel infiltration data and published effluent recharge data, evaluating existing groundwater well data, and estimating conservative losses to evapotranspiration based on published data. The methodology for the analysis is included in Appendix D. To assure the most conservative assessment, the maximum 30-day flow anticipated over the 20-year life of the plant (1.22 mgd) versus the average daily flow was used to represent the amount of water discharging to Greenbush Draw. Based on the analysis, the maximum amount of reclaimed water recharging the aquifer beneath Greenbush Draw within the DIA is

calculated at 587 AF/yr. This volume is distributed over a significant length of Greenbush Draw (approximately 8,000 feet) and represents a 7.4% increase in total basin inflows.

A portion of the basin fill aquifer in the Bisbee-Naco area is currently impacted by a groundwater sulfate plume. Investigations were conducted by Brown and Caldwell to assess whether the proposed location of the effluent discharge outfall would adversely impact the migration of the plume and degrade aquifer water quality within the DIA. Recent reports and data sets pertaining to the basin fill aquifer of the Bisbee-Naco area and the sulfate plume were collected and examined in order to evaluate the likelihood of any adverse impacts. Two primary resources were utilized in this investigation: a USGS report entitled "Ground-Water Resources of the Bisbee-Naco area, Cochise County, Arizona" by G. R. Littin (1987) and a groundwater model documentation report entitled "Groundwater Flow and Transport Model Report for CTSA APP Project Area" prepared by Savci Environmental Technologies (SET) for Phelps Dodge Corporation (1998).

Historical discharges from an evaporation pond associated with mine dewatering operations and from the Warren Ranch Irrigation area created a groundwater mound in the local basin fill aquifer and elevated background sulfate concentrations (Littin, 1987). SET (1998) developed a numerical groundwater flow and transport model to estimate the current and projected extent of the sulfate plume, defined as sulfate concentrations greater than 250 milligrams per liter (mg/L). A map of the sulfate plume derived from the model simulations is presented in Figure 13 and indicates that the plume is located outside of the planned discharge outfall location and its associated DIA. Model results also predict that the boundary of the plume will shift slightly to the west by the year 2048 but will remain to the north of the planned effluent outfall location. Given the information provided by Littin (1987), SET (1998), and the flow routing analysis conducted by Brown and Caldwell, both the location of the proposed discharge outfall and the estimated groundwater recharge zone for Greenbush Draw appear to be outside and downgradient of the current and future estimated extents of the sulfate plume (Figure 13). Furthermore, conservative estimates of recharge within Greenbush Draw represent a maximum of 7.4% of the total inflows to the basin fill aquifer. Thus, given the downgradient location of the outfall and the minimal impact of recharge to the basin fill aquifer water budget, it is unlikely that the discharge to Greenbush Draw at the proposed location would adversely impact the current position or future migration of the sulfate plume.

In accordance with the ADEQ Consent Order, effluent from the San Jose WWTP will be treated to a Class B+ Reclaimed Water. Class B+ reclaimed water is subject to secondary treatment and denitrification and must meet the treatment levels specified in Arizona Administrative Code (A.A.C.) R18-11-305. The fecal coliform concentration achieved through secondary treatment cannot exceed a 7-day average of 200 colony forming units (cfu) per 100 ml or a single maximum of 800 cfu/100 ml. BADCT requirements for a new treatment facility are defined under A.A.C. R18-9-B204 and must be met upon release of the treated wastewater at the outfall. BADCT specifies that the concentration percolating to groundwater cannot exceed an average of 2.2 cfu/100ml or single maximum concentration of 23 cfu/100 ml. Facilities that do not treat to this level are allowed to meet these criteria through the process of soil aquifer treatment (SAT)(R18-9-B204.A.4.c). SAT is accepted by ADEQ as an alternative method for removal of fecal coliform and may be used to meet BADCT requirements.

The Class B+ reclaimed water that is discharged into Greenbush Draw is expected to improve in water quality prior to reaching the basin fill aquifer. As the reclaimed water infiltrates beneath Greenbush Draw, the vadose zone functions as a natural filter for advanced treatment due to SAT. According to Bouwer (2002), SAT typically removes all suspended solids and micro-organisms (viruses, bacteria, and protozoa), and results in significant reductions in nitrogen concentrations due to denitrification and anaerobic ammonium oxidation processes. Additional SAT benefits include reductions in dissolved organic carbon, phosphates, and heavy metal concentrations. Most purification processes involving SAT are renewable and sustainable (Bouwer, 2002). Results of applicable studies conducted by Bouwer are included in Appendix E. In addition, the Class B+ reclaimed water will be disinfected with ultraviolet (UV) irradiation prior to discharge, which will reduce the potential for disinfection by-products to form in the DIA.

Currently, the basin fill aquifer of the Bisbee-Naco area experiences some recharge from rather poor quality municipal wastewater disposal and private septic systems leachate. Reclaimed water discharged to Greenbush Draw from the new San Jose WWTP would meet Arizona Class B+ standards and would be of higher quality and beneficial to groundwater recharge. Furthermore, once the WWTP is upgraded, it is estimated that 75 to 80 percent of the private septic systems will be taken out of service. While the studies conducted by Brown and Caldwell indicate that a percentage of the reclaimed water discharged to Greenbush Draw will recharge the aquifer within the DIA, based on the prescribed level of effluent treatment, SAT processes within the vadose zone, current water quality within the DIA, and the location of the sulfate plume relative to the DIA, Alternative 4 is considered most protective of groundwater resources.

3.10 Biological Resources

3.10.1 Vegetation

The vegetative habitats found within the study area are largely terrestrial, with small areas of riparian vegetation. Terrestrial habitats consist primarily of the mountainous habitat of the Mule Mountains and the Sonoran/Chihuahuan desert area.

In the Mule Mountains surrounding Old Bisbee, increased precipitation and cooler temperatures allow a diverse mixture of succulent grasses and native softwoods and shrubs to grow. This Chihuahuan Desertscrub upland community is characterized by dominant shrubs such as little-leaf shumac (Rhus microphylla), creosote bush (Larrea tridenta), whitehorn acacia (Acacia constricta), desert broom (Baccharis sarathoides) and honey mesquite (Prosopsis glandulosa). Cacti and succulents, which are present primarily on steep side slopes and rocky outcrops, include sacahuista (Nolina Microcarpa), common sotol (Dasylirion wheeleri), Palmer's century plant (Agave palmeri), and walkingstick cholla (Opuntia spinosior). Dominant grasses and forbs include sideoats gramma (Bouteloua curtipendula), Arizona cottontop (Digitaria californica), Bermudagrass, and tickseed (Coreopsis sp.). In the Sonoran/Chihuahuan habitat from San Jose to the south, a much drier habitat is found which generally supports sparse desert broom, mesquite and some grasses.

The major riparian habitat in the study area exists along Mule Gulch. The habitat along Mule Gulch is classified as a xeroriparian mixed scrub type, dominated by mesquite, desert broom and spiny hackberry (Celtis pallida). Scattered individual trees such as Goodling willow, Arizona walnut and velvet ash are also present. Near the Mule Gulch WWTP, the arroyo contains small patches of southern cattall (Typha domingensis) and knotweed (Polygonum sp.). Downstream from the Mule Gulch WWTP, wash terraces show evidence of heavy grazing by cattle and are dominated by thick mats of Bermuda grass and have been colonized by saltcedar (Tamarix sp.) seedlings and saplings. Trees are generally small and very widely scattered, but a small grove of ten widely spaced, large cottonwood trees is present on the south side of Greenbush Draw west of the Arizona Water Company Naco Pumping Plant (SWCA 2002).

Vegetation at the Mule Gulch WWTP site consists of landscape grasses and ornamental plants and a small area of Chihuahuan Desertscrub along the Mule Gulch arroyo. At the Warren and San Jose WWTP sites, the lagoons are surrounded by relatively flat, vacant lands containing creosote scrublands or abandoned agricultural lands containing grasses, forbs, and scattered trees and shrubs. Lands surrounding the Warren WWTP are heavily grazed by livestock.

3.10.2 Wildlife and Threatened and Endangered Species

A total of 23 species that occur in Cochise County and are federally-listed or are proposed for listing (Table 7) were identified as potentially existing in the study area by the U.S. Fish and Wildlife Service (USFWS). Of the 23 species, 21 were eliminated from further detailed evaluation because their known ranges are located well outside of the study area and/or the study area does not contain habitats similar to those known to support the species. Two

species were determined to have the potential to occur within the study area: the lesser long-nosed bat and the Chiricahua leopard frog.

Table 7. Threatened and Endangered Species
Candidates or proposed for listing by USFWS, Cochise County, Arizona

Common Name	Scientific Name	Status*	Elevation range	Habitat	Likelihood to occur in study area
Bald eagle	Haliaetus lucocephalus	T	Highly variable	Primarily migrant or wintering species in Arizona. Resident populations usually found along large rivers and lakes	Highly unlikely except as a passing migrant flying over study area
Brown Pelican	Pelacanus occidentalis californicus	E	Highly variable	Inhabits coastal areas; transient along Colorado River and occasionally transient in central Arizona lakes and streams after storms	Highly unlikely
Cactus Ferruginous Pygmy-Owl	Glaucidium brasilianum cactorum	E	<4,000ft	Sonoran Desertscrub, mature cottonwood/willow, mesquite bosques; generally below 4,000 feet elevation	Highly unlikely
Mexican Spotted Owl	Strix occidentalis lucida	T	4,100 to 9,000 ft	Inhabits mature forest and woodlands shady, steep and wooded canyons; typically in mixed conifer and pine-oak woodlands with multi-layered canopies.	Highly unlikely
Mountain Plover	Charadrius montanus	PT	Highly variable	Inhabits open, arid and short-grass prairies and cultivated fields; southeastern Arizona primarily provides wintering habitat	Highly unlikely
Northern Aplomado Falcon	Falco femoralis septentrionalis	E	3,500 to 9,000 ft	Grassland and savannah; low ground cover and mesquite or yucca for nesting platforms	Highly unlikely
Southwestern Willow Flycatcher	Empidonax trailli extimus	E	Highly variable	Inhabits dense riparian habitats along streams, rivers, and other wetlands with cottonwood, willow and other trees	Highly unlikely
Whopping Crane	Grus americana	E	4,500 ft	Inhabits marshes, prairies, river bottoms, potholes, playas, and agricultural fields: most occurrence in Arizona are migratory visitors to Wilcox Playa	Highly unlikely
Jaguar	Panthera onca	E	1,600 to 9,800 ft	Inhabits savannah, Sonoran Desertscrub and subalpine forests, usually near water; rarely found in extensive arid areas	Highly unlikely
Lesser Long-nosed Bat	**Leptonycteris curasoae yerbabuenae**	**E**	**<6,000 ft**	**Migratory species usually present in Arizona from April through September. Inhabits Desertscrub habitats with agave and columnar cactus. Roosts in caves and abandoned tunnels. Feeds on nectar and pollen of agaves and columnar cactus.**	**May occur in study area while foraging; study area is within known range and contains scattered patches of agaves within and adjacent to study area, however no roosts are present within study area.**
Mexican Gray Wolf	Canis lupis baileyi	E	4,000 to 12,000 ft	Extirpated from the U.S., but unconfirmed reports continue from Arizona. In recent years, a non-essential experimental population was introduced in the Apache-Sitgraves area, more than 150 miles north of the study area. Inhabits oak and pine-juniper savannahs in the foothills and mixed conifer woodlands.	Highly unlikely
Ocelot	Leopardus pardalis	E	<8,000 ft	Humid tropical and sub-tropical forest, savannahs and semi-arid thornscrub; desertscrub communities with very dense cover	Highly unlikely

Common Name	Scientific Name	Status*	Elevation range	Habitat	Likelihood to occur in study area
Chiricahua Leopard Frog	**Rana chiricahuensis**	**T**	**3,300 to 8,900 ft**	**Inhabits permanent waters or near-permanent waters including streams, rivers, backwaters, ponds, and stock tanks that are free of introduced fish and bullfrogs in Madrean oak woodlands and semidesert grasslands of the Madrean Archipelago.**	**May occur in study area; study area is within historic range and potential habitat created by treated wastewater effluent is present**
Sonora Tiger Salamander	Ambystoma tugrinum stebbinsi	E	4,000 to 6,300 ft	Inhabits moist cover sites such as rodent burrows and rotted logs; breeds in stock tanks. Known only from the headwaters of the Santa Cruz and San Pedro Rivers.	Highly unlikely
New Mexican Ridge-nosed Rattlesnake	Crotalus willardi obscurus	T	5,000 to 6,000 ft	Inhabits rocky areas in steep, rocky canyons in pine-oak and pine-fir forests; in Arizona known only from the Peloncillo Mountains	Highly unlikely
Beautiful Shiner	Cyprinella Formosa	T	<4,500 ft	Small to medium sized streams and ponds with sand, gravel and rock bottoms. Endemic to the Rio Yaqui River drainage system; extirpated by habitat loss and degradation; reintroduced to San Bernardino National Wildlife Refuge.	Highly unlikely
Loach Minnow	Tiaroga cobitis	T	<8,000 ft	Turbulent rocky riffles of mainstream rivers and tributaries with gravel or cobble substrate	Highly unlikely
Spikedace	Meda fulgida	T	<6,000 ft	Moderate to large perennial streams with rapid flow over sand and gravel substrates	Highly unlikely
Yaqui Catfish	Ictalurus pricei	T	<4,000 to 5,000 ft	Moderate to large streams with slow current over sand and rock bottoms; endemic to the Rio Yaqui River drainage system; extirpated by habitat loss and degradation	Highly unlikely
Yaqui Chub	Gila purpurea	E	<4,000 to 6,000 ft	Deep pools of small streams, pools or ponds near undercut banks; endemic to the Rio Yaqui River drainage system; extirpated by habitat loss and degradation; populations reestablished in Leslie Canyon, SBNWR and in a pond on Turkey Creek	Highly unlikely
Yaqui Topminnow	Poeciliopsis	E	<4,500 ft	Small to moderate sized streams, springs and cienegas, generally in shallows; endemic to the Rio Yaqui River drainage system; currently restricted to SBNWR and introduced population in Leslie Canyon	Highly unlikely
Canelo Ladies Tresses	Spiranthes delitescens	E	5,000 ft	Occurs in finely grained, highly organic, saturated soils in cienegas. Known only from four cienegas in the Canelo Hills in extreme southwestern Cochise County	Highly unlikely
Cochise Pincushion Cactus	Coryphantha robbinsorum	T	>4,200 ft	Occur only on gray limestone in Semidesert Grasslands in the extreme southeastern corner of Cochise County; the likelihood of undocumented localities is small	Highly unlikely
Huachuca Water Umbrel	Lillaeopsis schaffneriana spp. recurva	E	1,800 to 6,500 ft	Cienegas, perennial low gradient streams and associated wetlands	Highly unlikely

** Status Definitions: E – Federally endangered. T – Federally threatened. P – Proposed for listing*

Habitat information from Endangered and Threatened Species of Arizona, USFWS, Arizona Ecological Services Field Office.

A biological evaluation was performed to determine if habitat for the two species occurred and if any individuals existed in the study area.

No habitat suitable for use as hibernacula for the lesser long-nosed bat was found within the study area. The presence of water at Mule Gulch and the Warren and San Jose lagoons and some agave could attract individuals while foraging, but is unlikely. The termination of poor quality effluent into Mule Gulch may remove a potential source of toxicity for these and other wildlife and would have an overall beneficial effect.

Potential habitat for the Chiricahua leopard frog exists for an approximately 2.75 section of stream channel downstream of the Mule Gulch WWTP. No individual frogs or tadpoles were observed. The removal of poor quality effluent would serve to protect individual transient species, thereby avoiding the development of a 'sink' population. The introduction of high quality reclaimed water to Greenbush Draw could improve habitat conditions by the elimination of untreated sewer overflows and septic system leachate.

No Action Alternative

The No Action alternative would not impact biological resources in the study area, however the continued discharge of high metal content effluent into the Mule Gulch arroyo could adversely impact transient or potential future generations of Chiricahua leopard frog in the Mule Gulch arroyo.

Alternatives 1, 2, 3 and 4

No critical habitats were identified in the study area by either USFWS or the Arizona Game and Fish Department through the Heritage Database Management System. The results of the biological evaluation indicate the proposed wastewater system upgrade may affect but is unlikely to adversely affect the lesser long-nosed bat and the Chiricahua leopard frog. The project will have no effect on any of the other federally-listed species or species proposed for federal listing. Loss of some wildlife habitat and possibly some riparian species would occur at the Mule Gulch arroyo from the removal of effluent discharge under Alternatives 2, 3 and 4. However, removal of poor quality water from the arroyo will help protect those remaining species from effects of high metal concentrations.

On November 7, 2002, the USFWS concurred on EPA's finding that the project "may affect, but is not likely to adversely affect, the lesser long-nosed bat or the Chiricahua leopard frog." Their determination is included in this EA as Appendix B.

3.11 Cultural Resources

A cultural resources survey of the study area, in accordance with Section 106 of the National Historic Preservation Act, was conducted to determine if the proposed project would affect significant archaeological or historical resources within the study area.

No archaeological resources were identified within the study area. Currently vacant lots within the Old Bisbee area were identified as potentially having old building foundations, however no excavation is proposed within these vacant lots. The proposed conveyance pipelines between the Mule Gulch WWTP, the Warren WWTP, the San Jose WWTP, the Turquoise Valley Golf Course and existing mains near San Jose will not affect significant archaeological resources.

A Draft Memorandum of Agreement (MOA) has been prepared between the EPA, the City and the Arizona State Historic Preservation Officer (SHPO) concerning the project and potential impacts to National Register listed and eligible resources. The MOA requires adherence to the cultural resource treatment options contained in

Appendix B "Specific Guidelines for reconstruction and Replacement of Historical Structures and Features" of the Cultural Resources Survey (Desert Archaeology 2002). Treatment options are presented to protect sewer pipe, manhole covers, roads and highways, storm drains, sidewalks and curbs, stairways, retaining walls and vacant lots that contribute to the Bisbee mining town landscape (Table 9). The MOA also requires development of a treatment plan for additional archaeological investigations and additional coordination if final design plans include disturbance of vacant lots in the Old Bisbee area. The City of Bisbee, the EPA and the SHPO agree that these recommended treatment options will minimize any potential adverse effects that the project may generate involving options cultural resources.

According to the National Park Service, the City of Bisbee contains six sites listed on the National Register of Historical Places, including an Historic District which encompasses much of Old Bisbee (Table 8).

The Bisbee National Register Historic District is roughly bounded by Commerce Street on the south, St. Patrick's School on the west, Howell Avenue on the north and Chihuahua Hill on the cast. The district includes numerous structures originally used as residences, hotels, government buildings, post office, churches, saloons, banks, retail stores, and schools. The district is significant for its closely intertwined architectural and economic history. Although the Bisbee National Register Historic District consists of properties generally containing buildings, it can be argued that the entire mining town landscape within the Old Bisbee and Warren townsite areas of the City meets eligibility requirements for inclusion on the National Register. This landscape includes, but is not limited to, buildings, staircases, retaining walls, roads, sidewalks/curbs, storm drains, and aboveground utility piping. The integrity of the district landscape is dependent upon location, setting design, materials and feeling. Most of Old Bisbee is regulated by historical overlay zoning which is intended "to protect, preserve, and enhance the City's character, historical significance, and distinctive architecture (City of Bisbee 1988)."

The Phelps Dodge General Office Building within the Bisbee Historic District is designated as a National Historic Landmark. Today, the building serves as the home of the Bisbee Mining and Historical Museum.

Table 8. National Register Properties, City of Bisbee, Arizona

Property	Location	Date Listed
Phelps Dodge General Office Building	5 Copper Queen Plaza, Old Bisbee	1971
Muheim House	207 Youngblood Avenue, Old Bisbee	1979
Bisbee Women's Club	74 Quality Hill, Old Bisbee	1985
John Treu House	205 West Vista Avenue, Warren	1995
Saint Patrick's Roman Catholic Church	Oak Avenue, Old Bisbee	1995
Walter Douglas House	201 Cole Avenue, Warren	2000

Source: National Park Service, National Register of Historic Places

The Mule Gulch WWTP is located on a 1.84 acre site near the intersection of State Route 80 and the Warren Cutoff Road. The plant was constructed in 1941 and 1942 to serve the sanitary sewage needs of the City and its environs. This facility is significant as an excellent example of sanitary system engineering during the second quarter of the 20th century and represents a major step in the development of sanitation improvements for the City. It meets eligibility requirements for inclusion in the National Register under Criterion C and possibly Criterion A.

No Action Alternative

The No Action alternative will not impact historic structures or potential archaeological sites within the study area.

Alternatives 1, 2, 3 and 4

Each of the action alternatives would impact historic structures and/or contributing elements (stairs, sidewalks, etc.) of the Bisbee Historic District through the rehabilitation of the collection system in this section of the City (Table 9).

Under Alternatives 2, 3 and 4, the Mule Gulch WWTP would be abandoned in place. Abandonment of some elements of the Mule Gulch WWTP may require future data recovery if information about the plant will be lost through demolition or disrepair.

Table 9. Cultural Resources Effects and Recommended Mitigation Options

Resource	Project Effect	Mitigation Treatment Options
Sewer pipe	Early cast iron pipes will he replaced with new ductile iron, PVC, or HDP piping. Exposed, aboveground piping will be ductile iron.	Filling of abandoned subsurface pipes to reduce potential for collapse of surrounding soil matrix or overlying structures. Abandoned exposed cast iron pipes should be neatly cot and either left open or capped dependant on the aesthetic character of the location. Exclusive use of new ductile iron pipe in exposed locations to provide visual compatibility with existing surroundings.
Manhole covers	Rehabilitation or reconstruction of existing manholes. Placement of a new, tight-fitting, watertight manhole covers of contemporary materials and casting.	Rehabilitation of existing manhole covers, where possible, as an alternative to replacement. Where replacement of manhole covers is necessary, the design and casting of new covers should be similar to, or compatible with. the patterns currently in use.
Roads and highways	Patching of existing asphalt, concrete or brick roadways, streets and walkways where trenching methods are used. Patching of brick roads or walkways has potential to detract from historical landscape.	Where possible, brick streets should be preserved. If avoidance of brick streets is not possible, the original paving bricks should be reinstalled where they are visible or exposed. Patching of asphalt and concrete streets should be performed in accordance with engineering specifications and strive to have visual quality to avoid creation of highly noticeable patches.
Street railway	Use of trenchless methods for sewer pipe rehabilitation in area of remaining exposed rails should not affect this resource. Other currently unknown sections of rail may be encountered during trenching operations and may need to be removed.	None specified
Storm drains	If trenchless method can not he used, effects to the Mule Gulch Channel may include disturbance of this resource related to sawcutting and partial or total demolition in areas of pipe rehabilitation.	Preservation is the only treatment option recommended for the Arizona Street Channel. Where sewer pipe rehabilitation is necessary in association with the Arizona Street Channel, only trenchless methods should be used. For the Mule Gulch Channel, the recommended treatment option is minor repair and pipe removal. In other informal drainage features, where preservation is not possible, surface placement of pipe should be evaluated. If disturbance through trenching is required, wails should not be disturbed and drainage floors should be disturbed as little as possible.
Sidewalks and curbs	Much of the existing sewer main in Old Bisbee runs longitudinally beneath the sidewalk where manhole covers exist in the walkway. In heavy traffic areas of Old Bisbee, sidewalks are in good condition and pipeline rehabilitation will not likely result in demolition. However,	Avoidance of brick and concrete sidewalks is the best treatment option. Where preservation is not feasible, brick sidewalks should be restored using original bricks. Where preservation is not possible, reconstruction of concrete sidewalks should be minimized (joint-to-joint) and should be of similar color and aggregate size.

Resource	Project Effect	Mitigation Treatment Options
	in areas where sidewalk is in poor condition and in areas of secluded sidewalk, total demolition may occur.	
Stairways	In some areas of Old Bisbee, sewer pipe runs beneath, crosses, and runs longitudinally along stairway features. If trenchless methods cannot be used in these areas, new pipe will be installed along the same alignment. This situation would generally result in minor disturbance effects from cutting of stairway features or adjacent walls. In extreme cases, replacement of sewer pipe could require partial or total demolition.	Except where unsafe or very poor condition, preservation of stairways in current condition is the best treatment option. Avoidance options for sewer pipe rehabilitation include trenchless methods, placement of a parallel pipe under or above an adjacent embankment, or use of an alternate alignment to avoid the stairway. Where avoidance is not possible, partial reconstruction should avoid disturbing retaining walls and limit disturbance to steps. If replacement is necessary (generally more than 112 of the steps on a stairway must be removed), historical documentation of the stairway must be completed.
Retaining walls	The project will directly affect many retaining wall features, however the effect is expected to be slight. Old exposed iron soil pipe penetrating retaining walls is a common feature in Old Bisbee. Most of this 4-inch pipe will be replaced in location with a 6-inch pipe. This will require some drilling of walls to accommodate the larger pipe. If trenchless installation is not available, trenching in backfill areas may be necessary.	Avoidance of retaining walls is recommended where possible. Where drilling through retaining walls is necessary, work should be carefully done, damaged material should be replaced and appropriate filler material (such as mastic or grout) around new pipe openings.
Vacant lots	In some areas of Old Bisbee, there are historic records of buildings on currently vacant lots. In areas where sewer pipe runs through these lots, unknown archaeological sites may be disturbed or destroyed if sewer rehabilitation or replacement involves ground disturbance.	Complete avoidance of vacant lots is recommended. Where avoidance is not possible, a monitoring and discovery plan should be developed to address work procedures and work to be completed in the event archaeological resources are encountered

Source. Cultural Resources Survey of the Bisbee Wastewater System, Desert Archaeology, Inc. Technical Report 2002-02, February 2002

3.12 Cumulative Effects

To assess the potential cumulative effect of the proposed action, other past, present, and reasonably foreseeable future actions in the study area and region were considered. Other types of proposed actions considered were infrastructure projects, large-scale residential and commercial developments, and governmental programs or regulations affecting an individual resource.

Past actions affecting the resources of the study area include the historical mining activity in the area, residential and commercial development, and the development of infrastructure such as highways and water/wastewater utilities. Mining activities have had significant impact on the topography and aesthetics of the study area, and have various impacts on water quality, air quality, noise, wildlife and cultural resources since the beginning of the 20" century. Many of the environmental impacts generated by early mining activities, such as those affecting air quality impacts, noise and cultural resources have subsided with the decline of mining activities. Water resource impacts related to acid mine drainage continues to affect the study area. The introduction of wastewater infrastructure helped to relieve historic contamination of water resources from untreated or poorly treated wastewater from private septic systems.

Reasonably foreseeable future actions in the City are those potential private development projects used to project future wastewater demands. No future major infrastructure or governmental actions were identified as contributing to cumulative effects of the proposed action.

The proposed project would not result in a substantial cumulative effect, in terms of context or intensity, to the social and natural features in the Bisbee area. Wastewater system improvements would produce beneficial impacts on surface and groundwater resources by the elimination of poor quality effluent discharges which threaten water quality and wildlife species. Additional land development may occur in part due to the availability of increased wastewater treatment capacity, however future development potential in the City is more strongly influenced by geographical and economic forces. The limited projected land development, used as a basis for development of future wastewater treatment demands, would not change the social, physical or economic character of the City. Additional development is planned for areas that do not contain sensitive natural resources. The only potential major influence on the study area would be changes in the current level of mining activities in the area. Currently, mining activity in the Bisbee area is of minor influence on the social and economic characteristics of the area, but continues to influence environmental quality. If changes in technology or new finds in the area would increase mining activity, this shift would likely have a major influence on, and generate cumulative effects, over a variety of resources and concerns in the area. However, the proposed wastewater system will not affect the potential for additional future mining activities nor generate significant cumulative effects.

Section 4 - Public Involvement

Two public hearings have been conducted on the proposed improvements. Hearings on July 26, 2000 and August 3, 2000 provided project information to the public and attempted to address public questions. Each of the alternatives under consideration was discussed and Alternative 4 was identified as the City's preferred alternative.

In May of 2001, a public referendum vote was held to obtain approval for City expenditures to meet the requirements of the ADEQ Consent Order. The referendum was overwhelmingly approved by 95% of voters, who voted to approve $24 million in City bond indebtedness to rehabilitate the wastewater collection and treatment system.

References

Arizona Department of Economic Security, 1999. Arizona State Data Center, Population Statistics Unit. 1990 Census of Population and Housing.

Arizona Department of Economic Security, 1999. Research Administration, Population Statistics Unit. Arizona Subcounty Population Projections, July 1, 1997 to July 1, 2050.

Arizona Department of Environmental Quality, 2002. Air Quality Division. Air Quality Planning Non-attainment Areas & Listing. http://www.adeq.state.az.us.air/plan/

Arizona Department of Environmental Quality, June 1998. Press Releases: http://adeq.state.az.us.air/pr/1998/june98.htm

Asano, T. (ed), 1985. Artificial recharge of groundwater, Chapter 8, Renovation of Wastewater with Rapid-Infiltration Land Treatment Systems. Butterworth Publishers, London, pp. 249-282.

Bouwer, H., 1991. Ground Water Recharge with Sewage Effluent. Water Science Technology, Volume 23, pp. 2099-2108.

Bouwer, H., 1993. From sewage farm to zero discharge. European Water Pollution Control, Volume 3(1), pp. 9-16.

Bouwer H., Back, J., and Oliver, J., October 1999. *Predicting Infiltration and Ground Water Mounding For Artificial Recharge*, Journal of Hydrologic Engineering.

Bouwer, H., 2002. Artificial recharge of groundwater: hydrogeology and engineering. Hydrogeology Journal, Volume 10, pp. 121-142.

Chow,Ven Te, 1988. *Applied Hydrology*. McGraw-Hill Science/Engineering/Math.

City of Bisbee, Arizona, September 2002. Official Site of the City of Bisbee, Arizona. Internet page available at http://www.cityofbisbee.com/

City of Bisbee, Arizona, April 2001. Wastewater Master Plan Report. Gannett Fleming, Inc.

City of Bisbee, Arizona, June 1996. The Bisbee General Plan 1996-2006. Ordinance O-96-20, amended by Resolution R-97-09.

City of Bisbee, Arizona, March 1980. Final Report-Sewer System Evaluation Survey for the City of Bisbee, Arizona. Morris-Clester-Abegglen & Associates, Inc.

Commission for Environmental Cooperation, June 1998. Sustaining and Enhancing Riparian Migratory Bird Habitat on the Upper San Pedro River. Public Review Draft from the San Pedro Expert Study Team.

Desert Archaeology, Inc., February 2002. Cultural Resources Survey of the Bisbee Wastewater System, Bisbee, Cochise County, Arizona. Technical Report No. 2002-02. Prepared for the City of Bisbee, Arizona.

Desert Archaeology, Inc., February 2003. Addendum to the Cultural Resources Survey of the Bisbee Wastewater System, Bisbee, Cochise County, Arizona. Project Report No. 03-110. Prepared for the City of Bisbee, Arizona.

Lacher, Laurel J., December 3, 1994. *Hydrologic and Legal Issues of the Upper San Pedro River Basin, Arizona.* Department of Hydrology and Water Resources, University of Arizona.

Lacher, Laurel J., 1996. *Recharge Characteristics of an Effluent Dominated Stream Near Tucson, Arizona,* Ph.D. Dissertation, Department of Hydrology and Water Resources, University of Arizona.

Littin, G.R., 1987. *Ground-water Resources of the Bisbee-Naco Area, Cochise County,* Arizona, U.S. Geological Survey Water Resources Report 87-4103.

Phelps Dodge Mining Company, 2000. Meeting with Tom Weiskopf, Phelps Dodge and representatives of Arizona Department of Environmental Quality and Gannett Fleming, Inc.

Phelps Dodge Mining Company, 1998. Sulfate Concentration Map and Analytical Results for Groundwater Samples, Prepared by SAVCI Environmental Technologies, LLC.

SACVI Environmental Technologies, 1998. *Groundwater Flow and Transport Model Report CTSA APP Project Area, Bisbee, Arizona*, prepared for Phelps Dodge Mining Company.

Shafroth, P., J. Stromberg, D. Patten, A. Springer, and J. Wright, 1996. *Ground-water recharge and riparian habitat enhancement from water discharged from New Waddell Dam into the Agua Fria River: Phase I - Planning and Feasibility: Final Report submitted to Arizona Department of Water Resources - Phoenix Active Management Area*, 78 p.

SWCA, Inc., September 16, 2002. Biological Evaluation of the City of Bisbee Wastewater Treatment System Improvements, Cochise County, Arizona.

SWCA, Inc., February 2002. Bisbee Wastewater Improvement Project Agave Survey.

U.S. Department of Agriculture, Rural Utilities Service, December 1998. Guide for Preparing the Environmental Report for Water and Wastewater Projects. RUS Bulletin 1794A-602, Version 1.0.

U.S. Environmental Protection Agency, December 2000. BECC and NADBank: Promoting Environmental Infrastructure on the US-Mexico Border. http://www.epa.gov/oia/mex2.htm

U.S. Environmental Protection Agency, 2002. Welcome to the Green Book: Nonattainment Areas for Criteria Pollutants. http://www.epa.gov/oar/oaqps/greenbk/

U.S. Fish and Wildlife Service, Southwest Region. A species List for Cochise County. http://ifw2es.few.gov.endspcs/lists/